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ILLUSTRATED ICE GLOSSARY

BY TERENCE ARMSTRONG AND BRIAN ROBERTS

[*MS. received 21 October 1955.*]

Introduction

This illustrated glossary[1] of sea ice and associated terms is an abstract of a fuller illustrated glossary, also covering land ice terms, which the Institute has had in preparation for many years, and hopes to issue before long as a Special Publication. It is a development of an Admiralty glossary,[2] published in 1953, with such modifications as seem to be required for international agreement.

The shorter version given here is intended to be a practical aid to navigation, for use by mariners and those helping them to find a way through sea ice. An agreed terminology is an essential prerequisite for any system of reporting and recording. As ice reporting develops, it is likely to pass through essentially the same stages as meteorological reporting. Ice observers require the equivalent of the Meteorological Office's illustrated *Cloud Forms* (M.O. 233) to co-ordinate the identification of different kinds of ice and transmission of their records. In selecting terms the exacting requirements for coding and facsimile transmission have been borne in mind.

A similar glossary is being published by the Canadian Department of National Defence for use in Canadian waters. The present version is provisional, and comments will be welcome. The authors are aware that there may be a few discrepancies between this version and the Canadian, since by the time the latter is published, it should have been possible to smooth away the few remaining differences from the terms and definitions used in the United States.

It is realized that there will be a small number of differences between this glossary and the World Meteorological Organization's nomenclature, which is not yet published but will probably appear soon. The W.M.O. draft list, as yet unillustrated, suffers from the unavoidable disadvantages of international compromise. Furthermore, its aim is somewhat different in that it must cater for all the believed requirements of each country. The present glossary aims to cover the *minimum* number of terms required.

The differences, and readers' comments, will be taken into consideration when the longer version is issued. But it is necessary to lose no time in making the present version available, in order that it may be used by parties going to the Antarctic in connexion with the International Geophysical Year, the increased activities of the Falkland Islands Dependencies Survey and other enterprises.

The Institute would be grateful for any photographs which illustrate the terms better than those in the present version.

[1] Reprints are available from the Scott Polar Research Institute, price 5*s*.

[2] *Glossary of terms used on Admiralty charts and in associated publications, 1953. Part* 5. *Ice and snow terms.* London, Hydrographic Department, 1953. (Professional paper no. 11, 2nd edition.)

Glossary

(NOTE. *All items in italics will be found defined elsewhere in the glossary.*)

ANCHOR ICE

Submerged ice which is attached to the bottom.

BAY ICE

Fast ice of more than one winter's growth, which may be nourished also by surface layers of snow. Thickness of ice and snow up to about 2 m. above sea-level. When bay ice becomes thicker than this it is called an *ice shelf*.

BELT

A long area of *pack ice* from a few kilometres to more than 100 km. in width.

BERGY BIT Fig. 30

A massive piece of sea ice or disrupted *hummocked ice*; also medium-sized piece of floating glacier ice. Generally less than 5 m. above sea-level, and not more than about 10 m. across.

BESET Fig. 34

Situation of a vessel surrounded by ice and unable to move.

BIGHT

An extensive crescent-shaped indentation in the *ice edge*, formed either by wind or current.

BRASH ICE Fig. 9

Small fragments of floating ice, not more than 2 m. across; the wreckage of other forms of ice.

CALVING Fig. 33

The breaking away of a mass of ice from a *glacier*, *ice front* or *iceberg*.

CLOSE PACK ICE Fig. 13

Composed of *floes* mostly in contact, such that navigation is difficult even for specially constructed vessels and icebreaker assistance may be required. Ice cover 6/8ths to 7/8ths.

CONSOLIDATED PACK ICE Figs. 15 and 34

Pack ice in which the floes are frozen together. Ice cover 8/8ths.

CRACK

Any fracture or rift in sea ice not sufficiently wide to be described as a *lead*. It is usually possible to jump across a crack.

FAST ICE Figs. 10 and 19

Sea ice of greatly varying width which remains fast along the coast, where it is attached to the shore, to an *ice wall*, to an *ice front*, or over shoals, generally in the position where originally formed. Fast ice may extend 400 km. from the coast.

FLOE Figs. 17 and 18

A piece of sea ice other than *fast ice*, large or small. Light floes are anything up to a metre in thickness. Floes of greater thickness, both level and hummocked, are called heavy floes. Floes over 10 km. across are

described as vast; those between 1 and 10 km. across as large; those between 200 and 1000 m. across as medium; between 10 and 200 m. across as small. Floes less than 10 m. across are called *ice cakes*.

FRAZIL ICE Fig. 1

Fine spicules or plates of ice in suspension in water. The first stage of freezing, giving an oily or opaque appearance to the surface of the water (c.f. *Sludge*).

FROST SMOKE Fig. 39

Fog-like clouds, due to the contact of cold air with relatively warm sea water, which appear over newly formed *leads* or *pools*, or leeward of the *ice edge*.

GLACIER

A mass of snow and ice continuously moving from higher to lower ground or, if afloat, continuously spreading. The principle forms of glaciers are: *inland ice sheets*, *ice shelves*, ice caps, *ice piedmonts*, cirque glaciers, and various types of mountain (valley) glaciers.

GLACIER TONGUE

An extension of a *glacier*, projecting seaward, and usually afloat.

GROWLER Fig. 31

A piece of ice almost awash, smaller than a *bergy bit* (*q.v.*).

HUMMOCKED ICE Figs. 20 and 34

Sea ice piled haphazardly one piece over another, and which may be weathered.

HUMMOCKING

Process of pressure formation by which *level ice* becomes broken up into humps and ridges. When the *floes* rotate in the process it is termed 'screwing'.

ICEBERG Fig. 27

A large mass of floating or stranded ice broken away from a *glacier* or from an *ice shelf*. Often of considerable height (in any case more than 5 m. above the level of the sea).

ICE BLINK Fig. 40

Yellowish white luminous glare in the sky produced by the reflexion on the clouds of *pack ice* or an *ice sheet* which may be beyond the range of vision.

ICEBOUND

A harbour, inlet, etc., is said to be icebound when navigation by ships is prevented due to ice, except possibly with the assistance of an icebreaker.

ICE CAKE Fig. 11

A *floe* smaller than 10 m. across.

ICE CLUSTER

A concentration of sea ice covering hundreds of square kilometres, which is found in the same region every summer.

ICE COVER

The amount of sea ice encountered; measured in eighths of the visible surface of the sea covered with ice.

ICE EDGE Fig. 22

The boundary at any given time between the open sea and sea ice of any kind, whether drifting or fast. When wind or swell compact the ice edge it may be called a compacted ice edge; when dispersed, it may be called an open ice edge.

ICEFOOT Fig. 26

A narrow strip of ice attached to the coast, unmoved by tides and remaining after the *fast ice* has broken free.

ICE FRONT Fig. 38

The vertical cliff forming the seaward face of an *ice shelf*, varying in height from 2 to 50 m. (cf. *Ice wall*).

ICE ISLAND Fig. 29

A rare form of tabular berg found in the Arctic Ocean, with a thickness of 30 to 50 m. and from a few thousand square metres to 500 sq.km. or more in area. Ice islands are characterized by a regularly undulating surface, which gives them a ribbed appearance from the air. They originate chiefly from *ice shelves* in northern Ellesmere Island and northern Greenland.

ICE LIMIT

The average position of the *ice edge* in any given month or period based on observations over a number of years.

ICE PIEDMONT Fig. 35

Ice covering a coastal strip of low-lying land backed by mountains. The surface of an ice piedmont slopes gently seawards and may be anything from about 50 m. to 50 km. wide, fringing long stretches of coastline with ice cliffs. Ice piedmonts frequently merge into *ice shelves*.

ICE RIND Fig. 3

A thin, elastic, shining crust of ice, formed by the freezing of *sludge* on a quiet sea surface. Thickness less than 5 cm.

ICE RISE

A mass of ice resting on rock and surrounded either by an *ice shelf*, or partly by an *ice shelf* and partly by sea and/or ice-free land. No rock is exposed and there may be none above sea-level. Ice rises often have a dome-shaped surface. The largest known is about 100 km. across.

ICE SHEET

A continuous mass of ice and snow of considerable thickness and large area. Ice sheets may be resting on rock (see *inland ice sheet*) or floating (see *ice shelf*). Ice sheets of less than about 50,000 sq.km. resting on rock are called ice caps.

ICE SHELF Fig. 37

A floating *ice sheet* of considerable thickness. Ice shelves are usually of great horizontal extent and have a level or gently undulating surface. They are nourished by local snow accumulation and often also by the seaward extension of land glaciers. Limited areas may be aground. The initial stage is called *bay ice* until the surface is more than about 2 m. above sea-level. The seaward edge is termed an *ice front*.

ICE WALL Fig. 3

An ice cliff forming the seaward margin of an *inland ice sheet, ice piedmon* or *ice rise*. The rock basement may be at or below sea-level (cf. *Ice front*

INLAND ICE SHEET

An *ice sheet* of considerable thickness and more than about 50,000 sq.km in area, resting on rock. Inland ice sheets near sea level may merge int *ice shelves*.

LEAD Figs. 23 and 1

A navigable passage through *pack ice*; a lead may still be so called even covered with *young ice*.

LEVEL ICE Fig. 1

Sea ice with a level surface which has never been hummocked.

NEW ICE Fig. 1

A general and indefinite term for ice newly formed. It will be in th form of crystals, *sludge*, *ice rind*, or *pancake ice*, of thickness less than 5 cm

NIP

Ice is said to nip when it closes round a ship so as to prevent her passag A vessel so caught, though undamaged, is said to have been nipped. this situation persists, the ship is said to be *beset*.

OPEN PACK ICE Fig. 1

Composed of *floes* seldom in contact and with many *leads* and *pools*. Ic cover 3/8ths to 6/8ths. Navigation should be comparatively easy fo specially constructed vessels and with ice cover 3/8ths to 4/8ths even fo ordinary vessels.

OPEN WATER

A relatively large area of water free of ice.

PACK ICE

Any area of sea ice other than *fast ice*, no matter what form it takes or ho it is disposed. Pack ice cover may be reported in eighths, or may b described as *very open pack ice* (1/8ths to 3/8ths), *open pack ice* (3/8ths t 6/8ths), *close pack ice* (6/8ths to 7/8ths) and *very close pack ice* (7/8ths t 8/8ths with little, if any, water visible).

PANCAKE ICE Fig.

Pieces of newly formed sea ice usually approximately circular in shap with raised rims, and from one-third to 2 m. in diameter.

PATCH Fig. 1

A collection of *pack ice*, whose limits can be seen from the masthead even lower.

POLAR ICE Fig.

Extremely heavy sea ice, up to 3 m. or more in thickness, of more tha one winter's growth. Heavily hummocked, and may ultimately b reduced by weathering to a more or less even surface.

POLYNYA

A large area of open water, surrounded by sea ice and found in the sam region every year. One side is sometimes formed by the coast. Polyny commonly occur off the mouths of big rivers (cf. *Pool*).

POOL Fig. 20

Any enclosed sea water area in *pack ice* other than a *lead*, not large enough to be called *open water*. If a pool is found in the same region every year it is called a *polynya*.

PRESSURE ICE Fig. 15

A general term for sea ice which has been squeezed, and in places forced upwards when it can be described as *rafted ice*, *hummocked ice* or *pressure ridge*.

PRESSURE RIDGE Fig. 21

A ridge or wall of *hummocked ice* where one floe has been pressed against another.

PUDDLE Fig. 7

A depression on the surface of a *floe* or *glacier* filled with water (melted ice and snow), and in most cases fresh and drinkable.

RAFTING Fig. 19

The over-riding of one *floe* on another, the mildest form of pressure. Hence '**RAFTED ICE**'.

RAM Fig. 32

The underwater projection of ice from an *ice front*, *ice wall*, *iceberg* or *floe*.

ROTTEN ICE Fig. 8

Sea ice which has become honeycombed in the course of melting, and which is in an advanced state of disintegration.

SHORE LEAD Fig. 24

The stretch of navigable water between *pack ice* and the shore, or between *pack ice* and a narrow fringe of *fast ice*.

SLUDGE Fig. 2

A later stage of freezing than *frazil ice*, when the spicules and plates of ice coagulate to form a thick soupy layer on the surface. Sludge reflects little light, giving the sea a matt appearance.

STRIP Fig. 16

A long narrow area of *pack ice*, about 1 km. or less in width, usually composed of small fragments detached from the main mass of ice, and run together under the influence of wind, swell or current.

TABULAR BERG Fig. 28

A flat-topped *iceberg*. Most tabular bergs form by breaking from an *ice shelf* and show horizontal firn snow layers.

TIDE CRACK Fig. 25

The fissure at the line of junction between an immovable *icefoot* or *ice wall* and *fast ice*, the latter being subject to the rise and fall of the tide.

TONGUE

A projection of the *ice edge* up to several kilometres in length, caused by wind and current.

VERY CLOSE PACK ICE Fig. 14

Pack ice in which the *floes* are tightly packed but not frozen together, with very little, if any, sea water visible. Ice cover 7/8ths to 8/8ths.

VERY OPEN PACK ICE Fig. 1

Composed of loose, widely spaced *floes*. Ice cover 1/8th to 3/8ths.

WATER SKY

Dark streaks in the sky due to the reflexion on the clouds of *open water* broad *leads* or *pools*, in the *pack ice*.

WEATHERED ICE Fig.

Hummocked polar ice subjected to weathering which has given the hummocks and *pressure ridges* a rounded form. If the weathering continues the surface may become more and more even.

WINTER ICE Fig. 1

More or less unbroken, level sea ice of not more than one winter's growth originating from *young ice*. Thickness from 15 cm. to 2 m.

YOUNG ICE Fig.

Newly formed *level ice* in the transition stage of development from *ice rind* or *pancake ice* to *winter ice*. Thickness from 5 to 15 cm.

Classified summary

The following classified list provides a ready means of finding appropriate terms in use with regard to sea ice:

I. FLOATING ICE
- A. Development and decay
  - 1. New ice
    - (*a*) Frazil ice
    - (*b*) Sludge
    - (*c*) Ice rind (thickness less than 5 cm.)
    - (*d*) Pancake ice (about 30 cm. to 3 m. across)
  - 2. Young ice (thickness 5 to 15 cm.)
  - 3. Winter ice (thickness 15 cm. to 2 m.)
  - 4. Polar ice (thickness more than 2 m.)
  - 5. Rotten ice
  - 6. Brash ice (fragments not more than 2 m. across)
- B. Fast ice
  - 1. Fast ice
  - 2. Bay ice (thickness of ice and snow up to about 2 m. above sea-level)
  - 3. Ice shelf (thickness more than 2 m. above sea-level)
  - 4. Icefoot
- C. Pack ice
  - 1. Closeness of the ice cover (concentration)
    - (*a*) Very open pack ice (cover 1/8th to 3/8ths)
    - (*b*) Open pack ice (cover 3/8ths to 6/8ths)
    - (*c*) Close pack ice (cover 6/8ths to 7/8ths)
    - (*d*) Very close pack ice (cover 7/8ths to 8/8ths and hardly a vestige of sea water)
    - (*e*) Consolidated pack ice (cover 8/8ths, no sea water)

2. Arrangement
   (*a*) Ice limit
   (*b*) Ice edge (compacted or open)
   (*c*) Bight
   (*d*) Tongue
   (*e*) Patch
   (*f*) Belt
   (*g*) Strip
   (*h*) Ice cluster
3. Behaviour
   (*a*) Hummocking
   (*b*) Rafting
4. Size of floes
   (*a*) Floe (light or heavy, according to thickness, small, medium, large or vast according to size)
   (*b*) Ice cake (less than 10 m. across)
   (*c*) Bergy bit (less than 10 m. across and 5 m. above sea-level)
   (*d*) Growler (smaller than a bergy bit, almost awash)
   (*e*) Brash ice (fragments less than 2 m. across)
5. Surface features and weathering
   (*a*) Level ice
   (*b*) Pressure ice (rafted ice, hummocked ice, pressure ridge)
   (*c*) Weathered ice
   (*d*) Puddle
   (*e*) Ram
6. Openings in ice
   (*a*) Crack
   (*b*) Tide crack
   (*c*) Lead
   (*d*) Shore lead
   (*e*) Pool
   (*f*) Polynya
   (*g*) Open water
7. Sky and air indications
   (*a*) Water sky
   (*b*) Ice blink
   (*c*) Frost smoke

D. Icebergs
1. Tabular berg
2. Ice island
3. Bergy bit (less than 10 m. across and 5 m. above sea-level)
4. Growler (smaller than a bergy bit, almost awash)

II. Land ice. Glaciers
1. Types
(*a*) Ice sheet
(*b*) Inland ice sheet
(*c*) Ice piedmont
(*d*) Ice shelf
(*e*) Glacier tongue
2. Associated features
(*a*) Ice rise
(*b*) Ice front
(*c*) Ice wall
(*d*) Calving

III. Navigation in ice
1. Beset
2. Nip
3. Icebound

Acknowledgements

This work has resulted from discussions extending over fifteen years, and aims to co-ordinate a wide variety of views.

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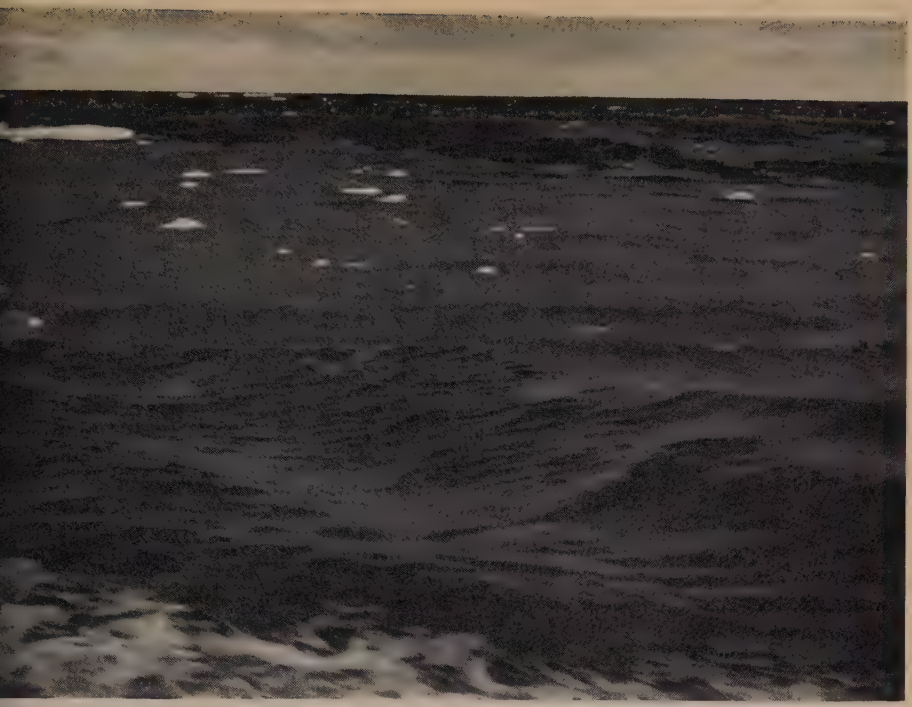
Grateful acknowledgement is made to the following for permission to use their photographs: Mr C. E. Ash (Figs. 2 and 31), Mr F. S. Chapman (Fig. 17), Professor F. Debenham (Fig. 26), Falkland Islands Dependencies Survey Scientific Bureau (Fig. 10), Mr J. F. Hurley (Figs. 5, 15 and 34), Hr S. Kjellberg (Fig. 37), Mr P. G. Law (Fig. 38), Surgeon-Commander G. Murray Levick (Fig. 30), Mr W. G. Metcalf (Fig. 7), National Institute of Oceanography (Figs. 9, 12, 13, 14, 18, 27, 28 and 36), Fil. dr. E. Palosuo (Fig. 19), the late Mr H. G. Ponting (Figs. 4, 21, 23, 33 and 39), Dr C. W. M. Swithinbank (Figs. 11, 22, 32 and 40), and Prof. Griffith Taylor (Fig. 25). Fig. 29 is Crown copyright. The remaining photographs (Figs. 1, 3, 6, 8, 16, 20, 24 and 35) are the authors' own.



g. 1. FRAZIL ICE. The oily appearance of the surface indicates the presence of frazil ice, which is forming round pieces of *brash ice.*

Fig. 2. SLUDGE.

Fig. 3. ICE RIND. The angular appearance of the small waves indicates the presence of a very thin layer of ice.

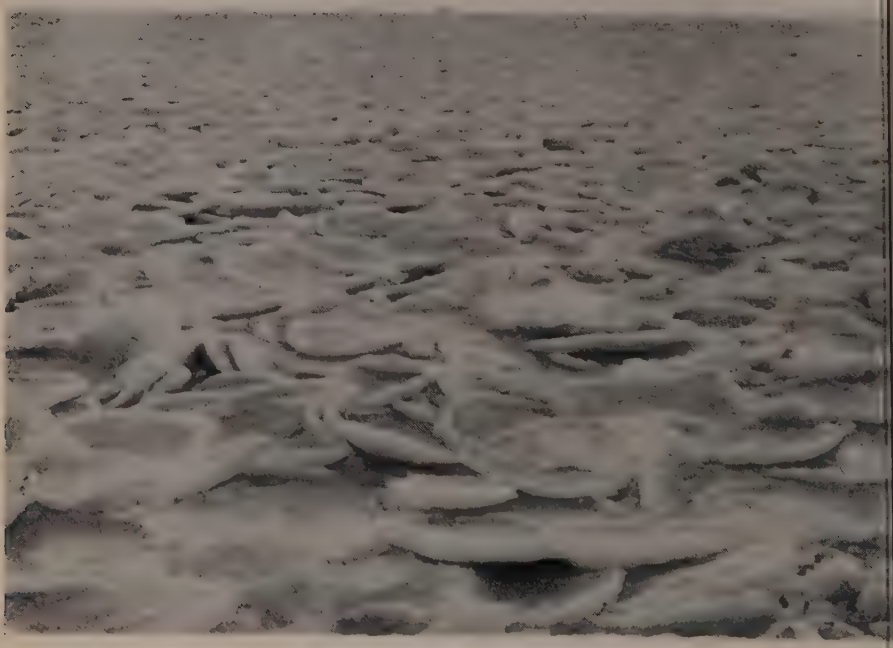


Fig. 4. PANCAKE ICE.

Fig. 5. YOUNG ICE. The mottled appearance of the ice and the straight edges of the ship's track cut through it are typical.

Fig. 6. POLAR ICE. The great thickness can be seen through the clear water. The rounded hummocks on the surface are *weathered ice.*

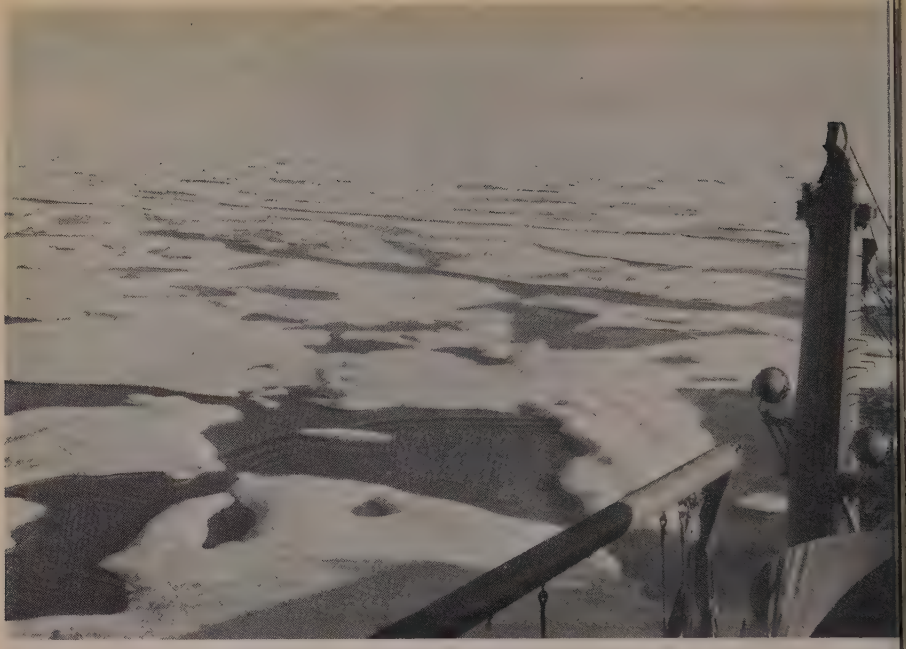


Fig. 7. PUDDLES.

Fig. 8. ROTTEN ICE. The *puddles* on the surface of the ice have mostly join together and in places have melted right through the ice.

Fig. 9. **Brash ice.**

Fig. 10. **Fast ice.** The *winter ice* in the left centre is fast between the mainland (from which the photograph is taken) and the island.

Fig. 11. VERY OPEN PACK ICE. *Ice cakes* are seen in the foreground.

Fig. 12. OPEN PACK ICE.

Fig. 13. CLOSE PACK ICE.

Fig. 14. VERY CLOSE PACK ICE.

Fig. 15. **Consolidated pack ice.** In the middle distance, amidst *pressure ice*, m
be seen an area of *level ice*; this is a frozen *lead* which has not been subjected to pressu

Fig. 16. **Strip.** The area of ice in the foreground is a small *patch*;
in the background a strip.

Fig. 17. LIGHT FLOES.

Fig. 18. HEAVY FLOES.

Fig. 19. **Rafted ice.** Rafting is most commonly found in *new ice*. Much of that see in this air photograph is still snow-free and transparent. *Fast ice* is held i position by islands in the background. The black areas are *pools*.

Fig. 20. **Hummocked ice.** A *pool* is seen in the left background.

Fig. 21. PRESSURE RIDGE.

Fig. 22. ICE EDGE.

Fig. 23. LEAD.

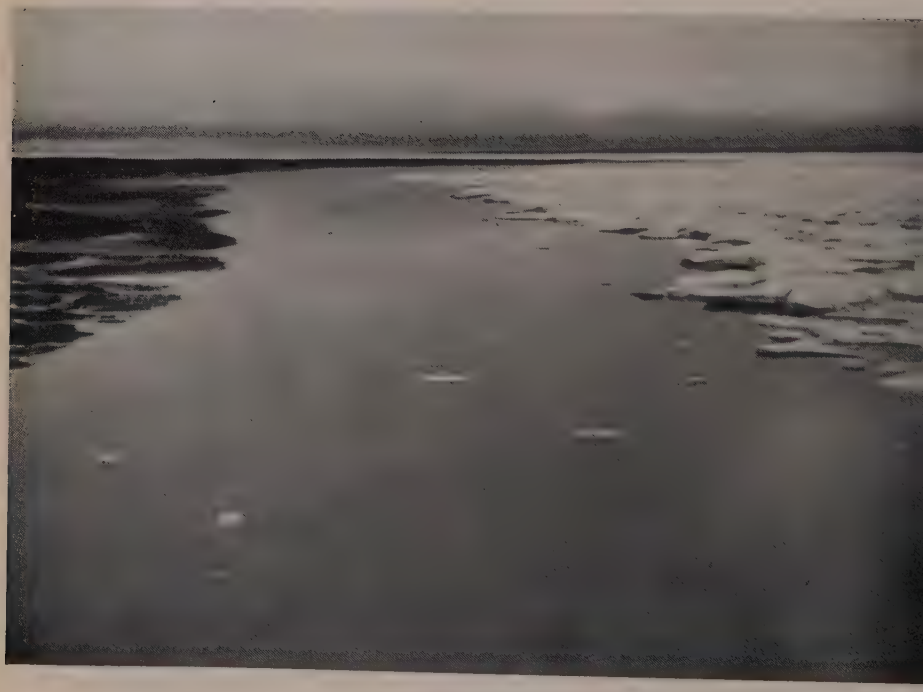


Fig. 24. SHORE LEAD.

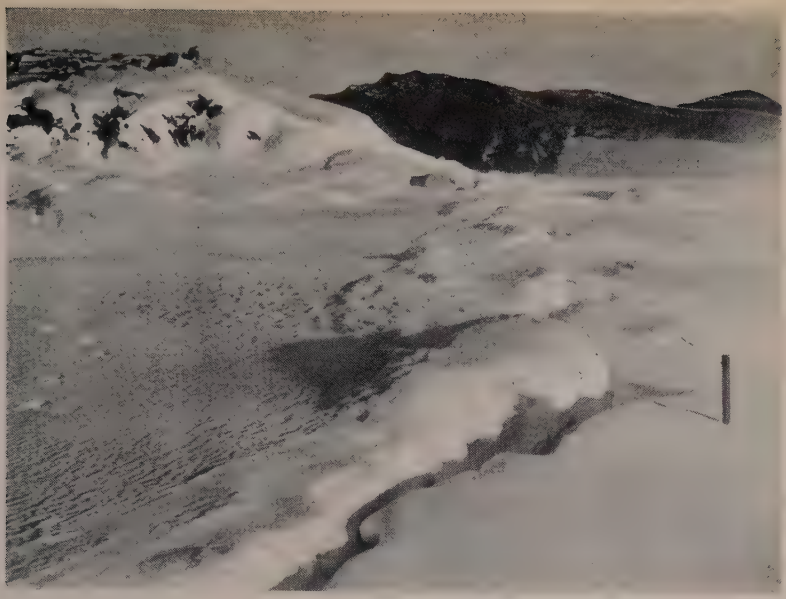


Fig. 25. **Tide crack.** The *ice foot* is on the left, with snow covered sea ice on the right.

Fig. 26. **Icefoot.** *Ice rind* is forming on the sea.

Fig. 27. ICEBERG.

Fig. 28. TABULAR BERG.

Fig. 29. **Ice island.**

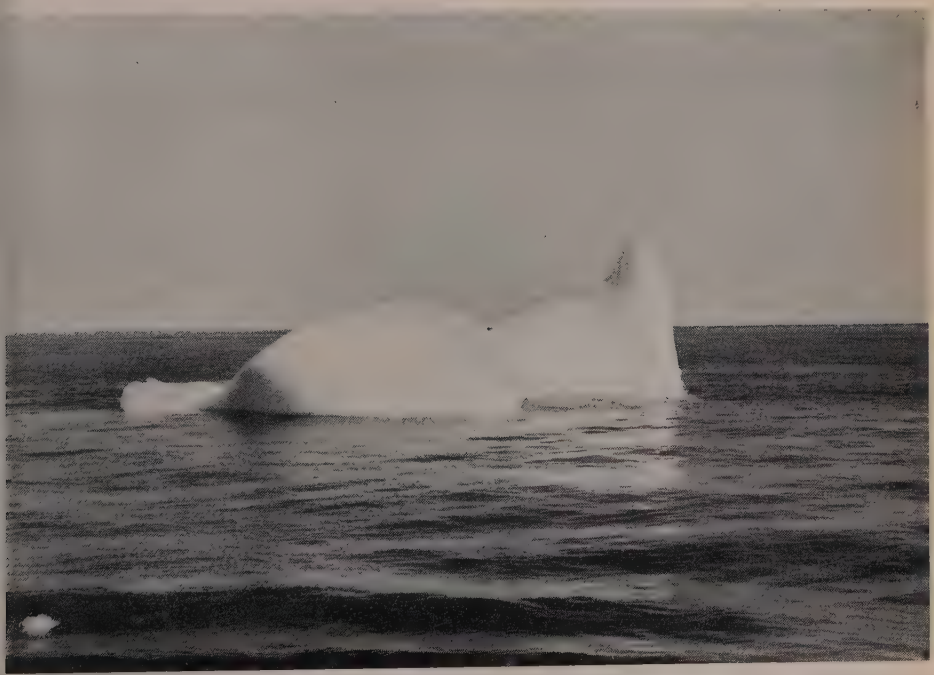


Fig. 30. **Bergy bit.** The smooth, rounded shape is due to water erosion.

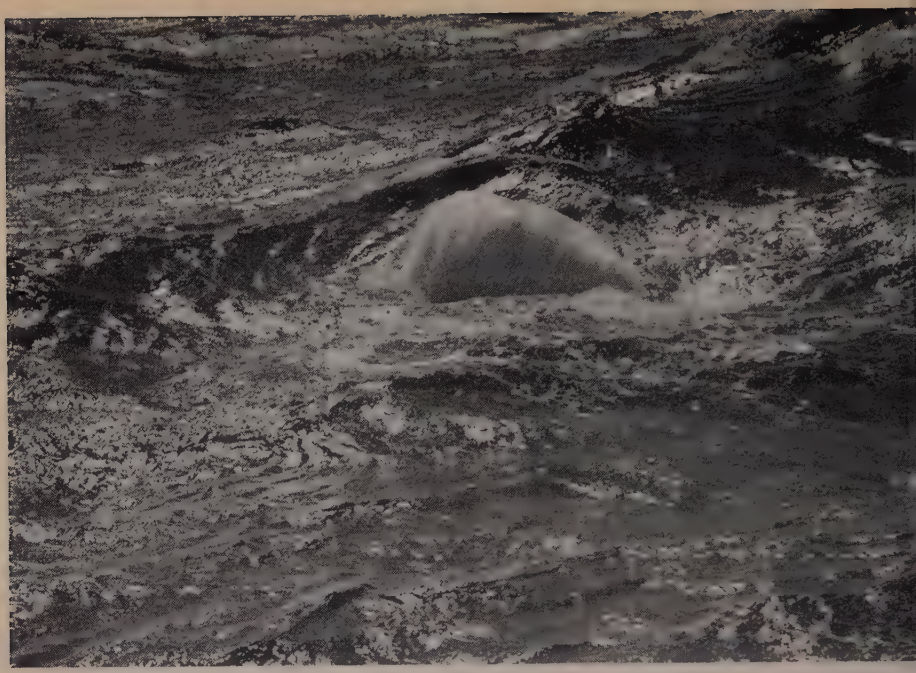


Fig. 31. GROWLER.

Fig. 32. RAM.

Fig. 33. CALVING.

Fig. 34. **BESET.** The ship is fast in *consolidated pack ice* which is heavily *hummocked.*

Fig. 35. ICE PIEDMONT.

Fig. 36. ICE WALL. The ice surface behind an ice wall slopes down towards the sea. Rock is often exposed at sea level.

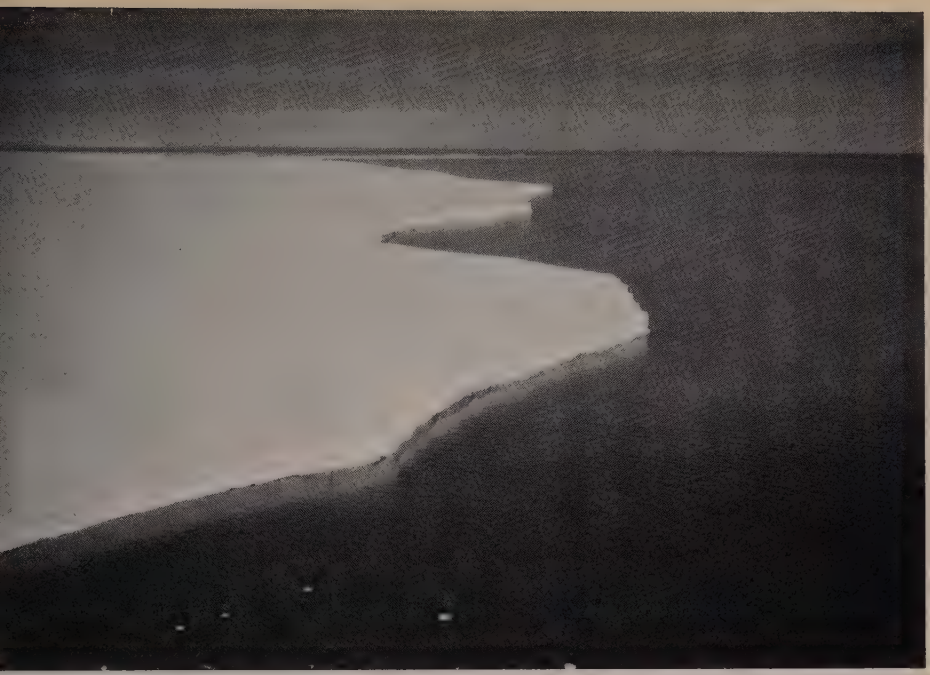


Fig. 37. ICE SHELF.

Fig. 38. ICE FRONT. The floating *ice shelf* behind an ice front is level or gently undulating.

Fig. 39. FROST SMOKE.

Fig. 40. ICE BLINK.

LOCAL COLD ACCLIMATIZATION IN MAN

BY N. H. MACKWORTH*

[*MS. received 25 July 1955.*]

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Introduction

Increased complexity in organisms narrows the range of body temperature within which effective function is found. The organism responds to this problem by developing both internal and external mechanisms for keeping a steady body temperature independent of the environment. However, there comes a point at which these protective devices break down; the study of the response to arctic conditions involves the study of these three aspects, namely, external protection, internal changes, and the nature of the failure to resist the cold. Bodily functions fail, as does the protective mechanism, from the outside inwards, the vital functions naturally being the last to fail. Recent advances in engineering, particularly developments in aviation, have tended to draw attention to the fact that the limits to arctic activities are usually set by the extent to which man can adapt himself rather than his machines. The adjustments made by people living in very cold regions include a whole number of changes in behaviour which can be grouped under the general heading of the techniques of arctic living.[1] Such changes in behaviour are obviously of the first importance for success and survival, especially when directed to the provision of a satisfactory private climate by the use of special clothing and shelter. Adjustments of a rather different kind from these can also be found in human beings attempting to adapt to arctic surroundings, and it is these other changes in human beings that are being considered here—the physiological and psychological changes that help men to meet the challenge of a cold environment.

Three points should be made at the start of any discussion on man's bodily and mental adaptation to cold:

(1) There is a remarkable and quite surprising shortage of hard facts on this subject which affects and interests a large and growing number of people.

(2) Such evidence as there is, does definitely point to real adaptive changes.

(3) The exact nature of some of these changes has still to be elucidated.

Recent scientific work on cold acclimatization in man has been discussed by Edholm and Burton in an important monograph on man in a cold environment.[2] They mention nine different measurements that should be considered in a complete examination of the response of man to prolonged exposure to

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cold: (*a*) heat formation, (*b*) calorie intake, (*c*) evidence of hormonal changes, (*d*) changes in body insulation, including thickness of body fat, (*e*) changes in vasomotor control of superficial vascularity, (*f*) changes in tolerance and performance, (*g*) evidence of diminished or increased incidence of cold injury, (*h*) evidence of local acclimatization, and (*i*) duration and persistence of any changes detected.

The picture presented by Edholm and Burton is all the more valuable because it is as complete as possible. It does, however, emphasize the fragmentary nature of current knowledge. Interesting pieces of this changing jigsaw are to be found scattered over an enormously wide range of sources.[3] The present paper summarizes research findings given in detail elsewhere.[4, 5]

Objective

One of the first reactions of the body on exposure to cold is a constriction of the peripheral blood vessels. This helps to conserve body heat in general, but leads to a rapid chilling of the exposed parts. Thus a mechanism which is good for survival is bad from the point of view of effective activities. It appears that acclimatized men do not show such a great peripheral constriction. While these phenomena are well-known, there is less known on the effect of these peripheral changes on efficiency. Any manual activity can be divided into at least two aspects, namely, movement and sensory 'feedback', and while it is possible to study the latter by itself, it is not possible to study motor activity separately from sensation. Therefore the first investigations must be to find what impairments of sensation are produced by the cold, and whether these changes occur when men become acclimatized.

The following work was undertaken to investigate this aspect of the problem. The two sensory mechanisms investigated were the tactile two-point discrimination and the vibration threshold. The work was carried out under two main conditions, first at Fort Churchill near Hudson Bay in Canada, and second in England, using a cold-room at Cambridge.

Procedure

The thirty men who took part in the field tests were members of the Canadian Army, scientists and labourers who had been at Fort Churchill for one to two winters. They were divided into three groups, ten outdoor and ten indoor, depending on whether they worked mostly outdoors or indoors, and a further ten formed a control group not exposed to cold. Half of the control group were indoor men and half outdoor men. All of them spent most of their free time in well-heated buildings.

The apparatus used to study the two-point discrimination was the V-test. This consisted of two halves of a ruler bolted together at one end and separated by a gap of half an inch at the other. The subject was instructed to say whether or not he could feel the gap between the two sides when the apparatus was pressed firmly against his finger. By taking a series of readings in random order it was possible to determine the smallest size of gap which could just be

detected. The difference between the minimal detectable gap measured in the warm and that measured under cold conditions gave an index of numbness for each man.

After ten preliminary readings in the warm, the subject put on thick woollen gloves, which left uncovered the index finger which was being tested. He went outside to a canvas-lined wind-tunnel in which the temperature was the same as that outside, i.e. between $-16°$ and $-25°$ C., but the wind speed could be adjusted by shutters, and was kept at either 4 m.p.h. or zero.

During the six-minute exposure to cold the subject stood in this tent, warmly wrapped except for his finger, and four V-test threshold readings were taken. The subject returned to the warm test room and a further twelve test readings were taken during the subsequent half an hour. Between these readings, observations were made on the skin temperature and on the vibration threshold.

The vibration threshold was determined by finding the least extent of movement of a stylus moving at a rate of 150 cycles per second required to give a buzzing sensation. Again the index of numbness was the distance through which the movement had to be increased to give the sensation of vibration under cold conditions.

The two experimental groups, the outdoor and indoor, were tested in the cold, and the third control group was repeatedly tested in the same way, except that they were in the warm all the time.

Results

Fig. 1 shows the change in the numbness index produced by cold exposure with a wind speed of 4 m.p.h. It can be seen that the indoor men showed a great increase in numbness as compared with the outdoor men.

Fig. 2 shows a similar but less marked difference in the vibration test.

Fig. 3 shows that the outdoor men had persistently higher skin temperatures before and during the exposure to cold. It is thought that this preliminary difference in skin temperature between the outdoor and indoor men is due to the reaction to the natural exposure on the way to the warm test room before the test began.

When the groups were tested in still air, no significant difference was found between them. It is clear that the increased severity of the conditions produced by the wind was necessary to show this difference. This is brought out by Fig. 4, which shows the relation of the windchill values on the Siple scale to the numbness scores on the V-test. This shows how under moderate conditions there was little difference between the two groups. As the conditions became more severe, so the indoor men became more numb, but the outdoor men were not affected until very severe conditions were reached, when there was a sudden failure. This indicates that certain acclimatization changes may only be measurable within a range of conditions, which may be just that range which is most likely to occur under natural circumstances.

This work was followed up by tests in England using a cold-room. The subjects were naval volunteers, and they were exposed to $-15°$ C. for two

hours a day five days a week—usually for five weeks. They were warmly dressed without any gloves. The two-hour test period ended with one-minute exposure of the test hand to a 6 m.p.h. breeze. The numbness index was the required increase in the size of the V-test gap in the cold as compared with

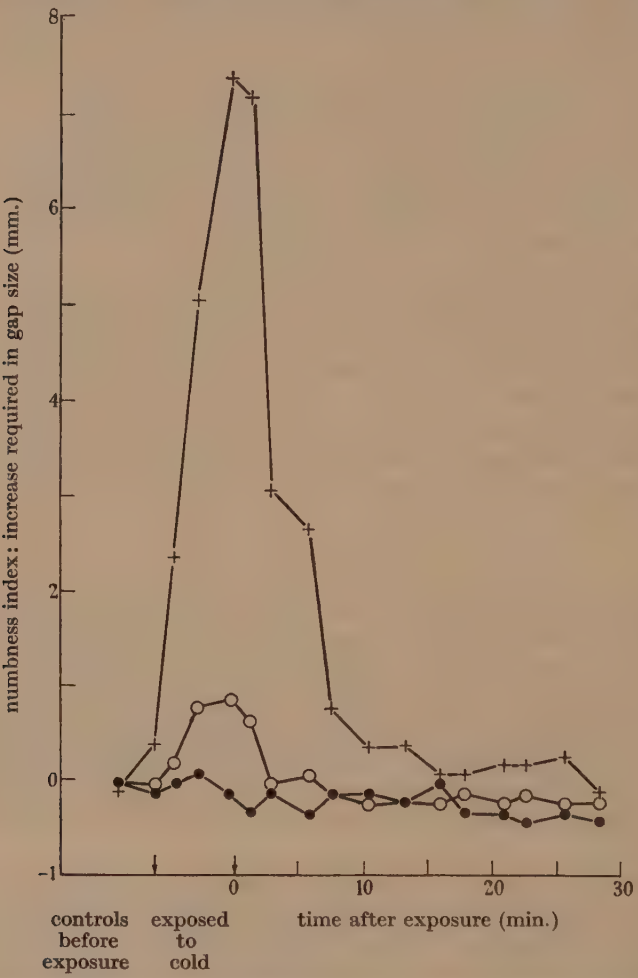

Fig. 1. Numbness trends from indoor and outdoor men—exposure to *slight winds*. V-test. +, indoor men; ○, outdoor men; ●, controls.

a reading taken before entering the cold-room on that same day. Fourteen men were tested in the winter when the outside air temperatures lay in the fifties, and six men were tested in the summertime when the maximum outdoor temperatures lay in the seventies. Fig. 5 shows that there was a definite decrease in the numbness index as the weeks progressed, when the tests were carried out in the winter. No such changes were found among the summer men. Moreover, these showed a numbness index which was usually twice that of the

winter men, suggesting that the latter were already partially acclimatized to cold as compared with the summer men. Fig. 6 shows the relation of the numbness index to the immediate outside temperature. It is probable that two hours' exposure to cold was not sufficient to dissipate the increased body heat present on the warmer days, and there are thus two opposing trends, the long-term acclimatization due to the prevailing temperature, and the immediate improvement produced by warmer weather.

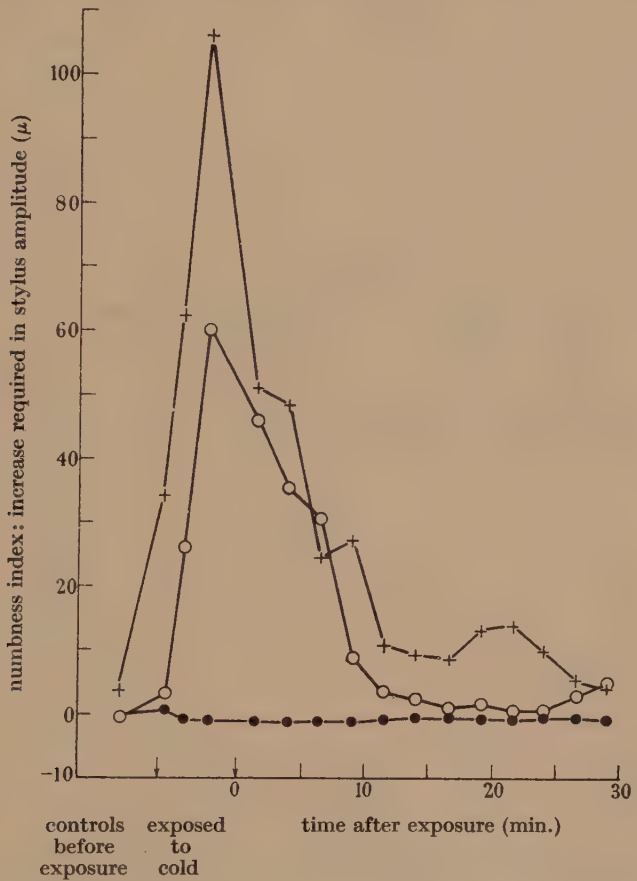

Fig. 2. Numbness trends from indoor and outdoor men—exposure to *slight winds*. Vibration test. +, indoor men; ○, outdoor men; ●, controls.

Discussion

Although man is usually able to exist under difficult conditions by adapting the environment rather than himself, it is necessary to learn just how he can adapt himself in order to know what engineering changes are essential. Moreover, there will always be conditions, especially in war time, when the engineering has no chance to catch up with the climate. Under such conditions, knowledge of the most important aspects of environmental stress may make

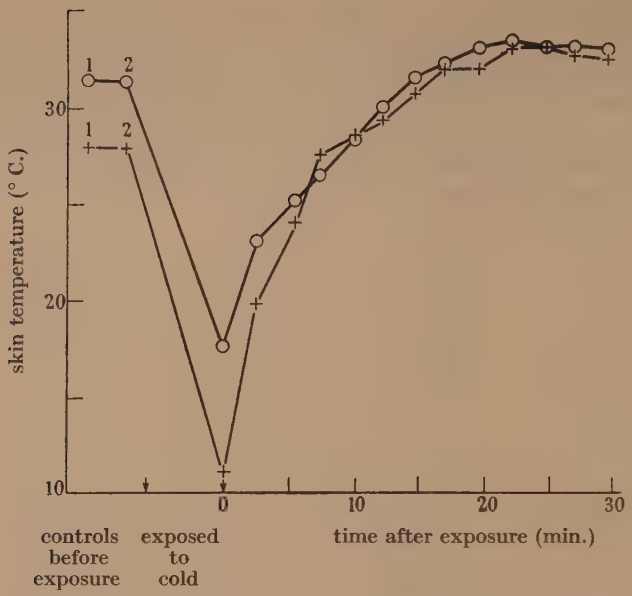

Fig. 3. Skin temperature trends from indoor and outdoor men—exposure to *slight winds*. 1 initial, 2 repeat control runs. +, indoor men; ○, outdoor men.

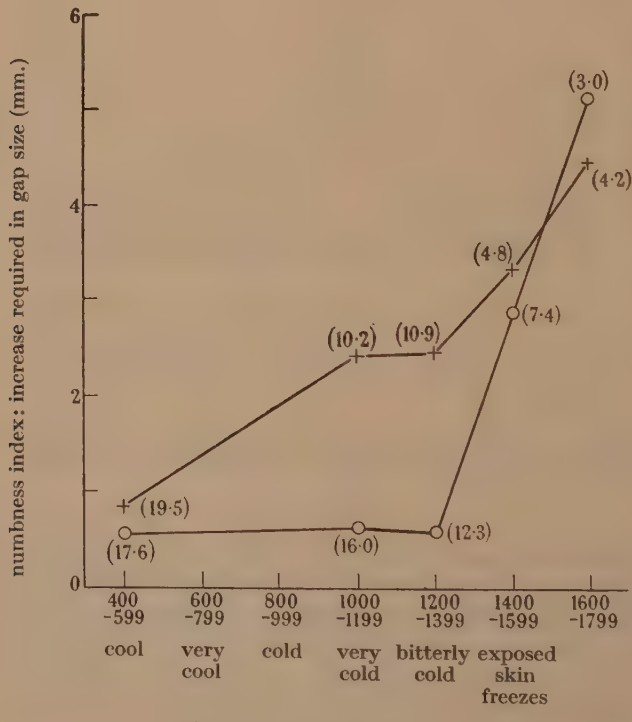

Fig. 4. Moderately severe wind chill numbs indoor men more than outdoor men. V-test, skin temperatures in brackets (° C.). +, indoor men; ○, outdoor men.

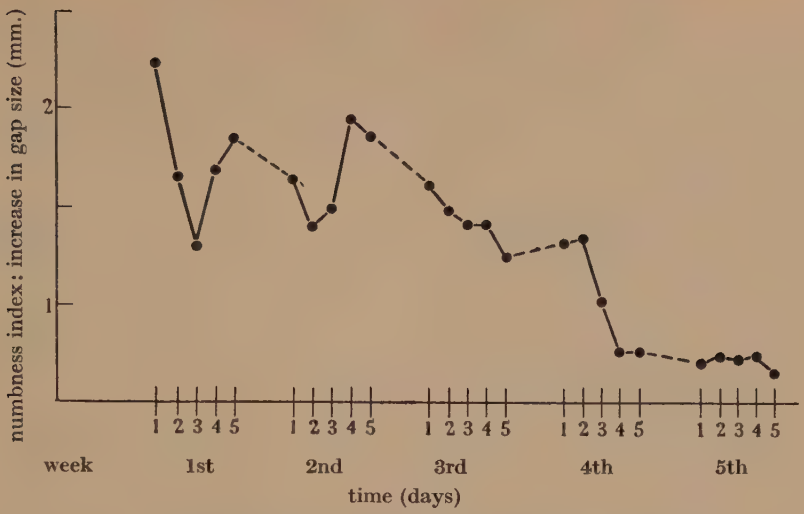

Fig. 5. Day-by-day trends in V-test numbness index during cold acclimatization exposure—*winter tests* ($N = 14$).

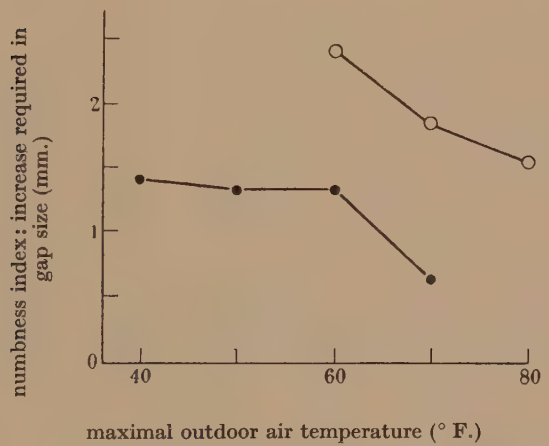

Fig. 6. Acclimatization effects plus the immediate effect of high outdoor temperatures. ○, summer tests; ●, winter tests.

the difference between survival or not. Quite small changes in the immediate circumstances, which can easily be made, may be all that is absolutely necessary. One simple example might be the erection of a tent over a stranded vehicle which has to be repaired by work with bare hands out of doors in an exposed position.

Carlson[6] has suggested that the bodily 'core' which the acclimatized man needs to keep at a steady temperature actually becomes smaller. This permits him to maintain circulation longer in the extremities with consequent increased dexterity. Carlson has also found that the skin temperature of the finger in the

acclimatized subject was higher at the beginning of cold stress and dropped less than in the non-acclimatized subject. Frazier[7] was a medical officer who spent a year with the U.S. Antarctic Service Expedition. He compared indoor and outdoor men, and found that frostbite appeared on the face within twenty to ninety seconds in the indoor group, whereas about ten minutes was needed for the outdoor group.

Brown and Page[8] have shown that Eskimo not only have slightly higher skin temperatures than Canadian medical students, but they also have resting hand blood flows at 20° C., which are nearly twice as great as that of the students. Molnar,[9] too, has worked on Eskimo. He found that pure-bred Eskimo who worked outdoors had fingers which did not start to cool down so early as did those of comparable indoor workers, this initial delay being as long as thirty to forty-five minutes.

The experimental work most needed in these problems is to determine by cold-room studies whether cold acclimatization assessed by a reduction in finger numbness scores is accompanied by rise in skin temperature and finger blood flow.

The existence of acclimatization to almost any fairly constant level of temperature is obvious from a common-sense view. The American coming to England finds his first winter unendurable, but after a year or two, when he returns to America he finds the indoor temperature there impossibly high, just as does the Englishman. Similarly, the Eskimo cannot endure the temperatures found farther south. In ourselves we see every spring how the mild cold spell we meet in May seems far worse than an equivalent spell in winter, when the temperature would have seemed delightfully warm. Somehow the individual thermostat becomes set at a given level, and departures from this level are accompanied by discomfort until it is adjusted. However, while it is easy to show acclimatization to heat, it appears to be extremely difficult to obtain reliable scientific proof of it in the cold. One reason for this is that since the thermostat appears more sensitive to heat than to cold, it is more influenced by those parts of the day when the subject is not being exposed to the cold. In other words, it is likely that to obtain reliable acclimatization the subjects must remain for a long time in a cold environment, that is, they must spend several weeks in temperatures which never become very high. This is why experiments carried out in an English winter give results which cannot be obtained during the summer. It seems most likely that if men are to work outside in the cold their living quarters should not be too well heated.

In addition to the short-term, self-regulatory adjustments associated with a thermostat in the brain, it is possible that such a thermostat learns to make long-term adjustments to its setting according to the general living conditions. It should not therefore be possible for such a thermostat to adjust itself both to warm living conditions and to cold exposure at the same time. One or the other must be the deciding factor, and since the mechanism is undoubtedly more sensitive to heat, there must be a marked predominance of cold to produce acclimatization. Since man is probably originally a semi-tropical animal, this may be the reason for the dominant heat sensitivity of the thermostat.

Cold acclimatization appears to act by reducing the changes necessary for the body when exposed to cold. The immediate reaction of the unacclimatized man to cold appears to be one designed to conserve body heat at the expense of manual efficiency, namely, peripheral vasoconstriction. This is accompanied by changes designed to increase the production of heat, such as shivering and increased calorie intake. However, the body appears to learn that it is not necessary for it to conserve so much heat, and it is enabled to heat a smaller central core. Moreover, the organism is able to live comfortably at temperatures which are very uncomfortable to the unacclimatized. The lack of the normal reaction of vasoconstriction not only enables manual efficiency to be retained, but also maintains comfort, which depends on the skin temperature.

It is possible to wonder whether the marked, uncomfortable and incapacitating reactions of unacclimatized man are absolutely necessary. Has acclimatized man actually more resistance to the lethal effects of cold, or has the brain learnt that it can allow heat loss to proceed further without danger to survival? Can the changes in adjustment be compared with the transition from the violent over-adjustment seen in the early learning of a muscular skill to the delicate almost imperceptible movements so characteristically found in the highly skilled performer?

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THE ARCTIC INSTITUTE OF NORTH AMERICA

BY P. D. BAIRD*

[*MS. received 13 May 1955.*]

The Arctic Institute of North America was established in 1945 in two small rooms in McGill University, with a staff consisting of Dr Lincoln Washburn and a secretary, who made up for the lack of equipment and facilities by abundant energy and enthusiasm. Since then the Institute's growth has been considerable, always in the direction of its three main objectives—to form a centre for reference information and study on the North American Arctic, to encourage arctic scientific research in any field, and to disseminate arctic information by means of a journal, other publications, and lectures.

Montreal was selected as the headquarters, lying as it does in the territory of the partner junior in population but senior in arctic area, and being a large, readily accessible city in the densely populated east. There are also two universities in the city, and the attachment of the Institute to one of them has given it academic standing, valuable advice, and a source of human material for the scientific research projects. The old office has been demolished, but to-day in another McGill University building is housed the very considerable map collection and library that has grown up, a permanent staff of five, and usually three or four research students. For seven years the author was director of this office and has been succeeded by Dr S. Orvig.

In 1947 an office in New York was opened and has remained under the directorship of Walter Wood. Two years later, to cope with increasing U.S. Government interest and to maintain close touch with the Office of Naval Research, an office in the Washington area was established. The directorship of this has been held by Dr M. C. Shelesnyak, Dr A. L. Washburn and now by Rear-Admiral L. O. Colbert.

The Institute's growth has been equally great in the assistance given to field research projects. Starting in 1946 with three fellowships, assistance has now been given to well over a hundred individuals or expeditions, and in 1950 the value of these grants was $50,000. Much of the money for these projects has come from the Office of Naval Research in Washington, other support has been given by the Canadian Government through the Defence Research Board, and by the Carnegie Corporation. The latter has provided the funds for a joint undertaking with McGill University for scholarships and field studies by graduate students. Senior scientists from Britain who have obtained research grants have included Dr Nicholas Polunin, Peter Scott, Dr T. T. Paterson, Professor V. C. Wynne-Edwards, Miss Marjorie Findlay and the present director of the Scott Polar Research Institute.

The major field projects of the Institute have been the "Snow Cornice

* Director of the Arctic Institute of North America, 1947–54.

expeditions of 1948, 1949, and 1951, led by Walter Wood, and the Baffin Island expeditions of 1950 and 1953, organized by the author. The initial voyages of D. C. Nutt's research schooner *Blue Dolphin* on the Labrador coast were also sponsored by the Institute.

An important research project has been the Arctic Bibliography prepared in Washington under the direction of Miss M. Tremaine. After six years intensive labour the first three volumes of this appeared in 1953, and two more have now been published.

The Institute has recently assumed the scientific direction of the Arctic Research Laboratory at Point Barrow, Alaska.

The Institute has played a steady part in the field of public relations and dissemination of arctic information. An associate membership programme and a journal were started in 1948. The latter, *Arctic*, has appeared first in two numbers, then three, and now four numbers annually. The first editor was Dr Trevor Lloyd, but for the last six years the high quality of material published has been maintained by Diana Rowley, who has just relinquished her post to Beryl Bird, a geography graduate of Cambridge.

Membership in the Institute rose rapidly to past the 2000 mark, but has yet to reach 3000. In addition, a senior class of the members, fellows, are elected from time to time, and have a vote in selection of half the governing body of the Institute. This governing body consists of eighteen members, one from Denmark to give Greenland affairs a voice in the Institute, and the remainder nearly equally from Canada and the United States. One-third of the governors retire annually and only a single re-election is permitted so that no member may serve for more than six years without, at least temporarily, retiring. International co-operation in Arctic science has been a steady aim of the Institute, and has been a source of strength to it both from the financial standpoint, and for the advancement of science.

Lincoln Washburn resigned from the executive directorship in 1952 and was succeeded by R. C. Wallace who had recently retired from the position of Principal of Queen's University. His elder statesmanship was of great value to the Institute and his sudden death last winter was a great loss to the organization and to his many friends who worked in or for it. T. H. Manning has succeeded and Lincoln Washburn is back as a member of the Board of Governors.

In detailing the main aims and functions of the Institute many minor activities have been omitted. One of these has been the organization of an arctic course at the McGill Summer School of Geography. The group of associates in Montreal have formed a winter lecture society and many interesting meetings have been held. As a source of reliable information more and more use is being made of the Institute's offices by business and industry, bibliographers and members of the armed forces.

It is in this way particularly as a research centre, that the Institute is taking its place as the North American counterpart of the older-established institutions in Britain, Scandinavia and the U.S.S.R.

FIELD WORK

ARCTIC WEATHER FLIGHTS FROM ALASKA, 1947–55[1]

[Summarized from information provided by Headquarters, Air Weather Service, United States Air Force, Washington.]

The first weather reconnaissance flight by the 58th Weather Reconnaissance Squadron from Fairbanks, Alaska, to the North Pole and back was made in March 1947. Daily flights are now made by the squadron from the base at Eielson airfield to lat. 85° N., a flight of 2800 nautical miles taking some 14 hours. During the flight weather observations are taken each half-hour and dropsonde recordings six times at periodic intervals. In addition to weather data, observations are taken visually of the aurora and, both visually and by photograph, of the pack ice.

With the exception of a small number of ground weather stations these "Ptarmigan" flights are the only source of weather data north of lat. 72° N.

ETHNOLOGICAL WORK BY LANDSMÅLSARKIVET I UPPSALA IN NORTH SWEDEN, 1950–53

[Summarized from *Svenska Landsmål och Svenskt Folkliv*, Årg. 75, Häfte 1–4, 1952, p. 172–73, and Årg. 76–77, Häfte 1–8, 1953–54, p. 356 and 372.]

Lapland

In the course of the year 1950–51 Nomadlärare C. Johansson continued his investigations of Lapp sacrificial sites at Gällivare.

Fil. kand. T. Sköld studied the Lappish dialect in the villages Norrkaitum and Sörkaitum in Gällivare parish in 1950, and made linguistic, ethnological and folk-lore investigations in Riekkossuven and other Lapp dwelling places in the same parish in 1951.

Professor Björn Collinder and Fru Britta Collinder made tape recordings of Lappish dialect and folk tradition in Jokkmokk and Arvidsjaur in September 1951, and Fru Collinder continued the recordings in Arjeplog in November.

In the course of his study of Lule-Lappish, Fil. dr. Harald Grundström spent September of both 1950 and 1951 in the parish of Jokkmokk. In the summer of 1952 Docent Israel Ruong travelled in Tärna, Arjeplog, Sorsele and Stensele parishes to study reindeer husbandry and to gather material for the completion of Dr Grundström's Lule-Lappish dictionary.

In 1950 Folkskollärare N. Eriksson started investigating folklore and customs at the Lapp settlement of Fatmomakke in Vilhelmina parish, and continued this work in 1951 and 1952.

In June 1952 Docent Karl-Hampus Dahlstedt studied the dialect in Vilhelmina parish, and in the summer of the same year Fil. stud. U. Eriksson made sound recordings and carried out phonetic investigations in Åsele parish.

Norrbotten

Dialect investigations were carried out in Norrfjärden parish by Fil. mag. Rigmor Lundberg in 1950 and by Folkskollärare E. Lundberg in 1950–51 and 1952, and in Överluleå parish by Läroverksadjunkt I. Norrby in 1950 and 1952. Fru Anna Rönnqvist studied popular traditions in Nederkalix parish in 1950, 1951 and 1952.

[1] A note on the Arctic weather reconnaissance flights by the 53rd Weather Reconnaissance Squadron from Great Britain appeared in the *Polar Record*, Vol. 7, No. 51, 1955, p. 490.

ABERDEEN UNIVERSITY EXPEDITION TO SPITSBERGEN, 1954

[Summarized from information provided by Dr E. A. FitzPatrick.]

Between 10 July and 26 August 1954 a party led by E. A. FitzPatrick of the Department of Soil Science, Aberdeen University, studied soil and plant conditions near Longyearbyen. The other members of the party were:

A. C. Crundwell (Glasgow University)
Ola Einevoll (Norges Landbrukshøgskole)
T. E. Fletcher (London School of Hygiene and Tropical Medicine)
J. Smith (Macaulay Institute for Soil Research, Aberdeen)

The object of the expedition was to find out whether the study of local conditions would explain the origin of the indurated subsoils which are almost universal in well drained sites in north-east Scotland, and common in parts of England and Norway. These subsoils are often impenetrable to roots and may be the cause of widespread up-rooting of trees during storms. It is not known, however, whether this compaction is inherent in the soil's parent material, or due to subsequent weathering.

The area chosen was immediately north of Longyearbyen, in particular in Adventdalen. Here the soil structures showed a striking similarity to those in the indurated layer in Scottish soils, and suggested that the phenomena observed in the latter could have been produced under corresponding conditions of permafrost.

AUSTRIAN EXPEDITION TO SPITSBERGEN, 1954

[Summarized from *Till Fjälls* (Stockholm), 1954, p. 40–47 and *Die Alpen*, 31 Jahrg., No. 6, 1955, p. 157–60.]

During the summer of 1954 a party of mountaineers belonging to the Hochalpinistische Gruppe Bergland visited the north-west corner of Vestspitsbergen. Its members were:

Hans Gsellmann, Leader (Austria)
Gillis Billing (Sweden)
Anne-Marie Luschin (Austria)
Helmut Seerainer (Austria)
René Simek (Austria)
Per Vigerust (Norway)
Hans Wörndl (Germany)

They were taken by motor-boat from Ny-Ålesund to Kapp Guissez at the mouth of Krossfjorden, on 11 July, and reconnaissance revealed excellent ski and pulka conditions, with snow down to 150 m. above sea-level, and rarely melted above 300–400 m. On 15 July they rowed in their own boat to Fanciullipynten farther up Krossfjorden, and established the base camp. From then until 7 August the party split into three climbing groups, while Anne-Marie Luschin remained at the base camp. Several peaks in the area east of Krossfjorden and Kongsfjorden were climbed, including Foreltinden, 1251 m. (Gsellmann and Simek), Kongen, 1424 m. (Vigerust and Billing), Eidsvollfjellet, 1445 m., Heibergtinden, 1266 m., Ringnestinden, 1281 m., Rekstadsfjella, 1262 m., and—previously climbed—Tre Kroner, 1226 m. (all by Wörndl and Seerainer). Gsellmann suffered from snow blindness on his way back from Woodfjorden, after losing his snowglasses, and Wörndl and Seerainer had frostbitten fingers and toes after exhausting experiences in the Isachsenfonna area. From 7 to 14 August two pulka journeys were made, over Haakon VII Land to Bockfjorden, and then to the Karlsbreen area; Storingen (previously called Le Colosse), 1145 m., and Wergelandfjella, *c.* 1300 m., were climbed. The party returned to Ny-Ålesund by motor boat on 14 August. In all, some thirty peaks in the area were climbed, it is thought, for the first time.

OXFORD UNIVERSITY EXPEDITION TO NORDAUSTLANDET, 1955

[Summarized from information provided by J. T. Hollin.]

During the summer of 1955 an expedition, under the auspices of the Oxford University Exploration Club, visited Nordaustlandet to carry on the glaciological work started by the Oxford and Cambridge Spitsbergen Expedition, 1951.[1] Members of the expedition were:

J. T. Hollin, Leader and geographer (Oxford)
C. A. Bunton, Glaciologist (London)
J. J. Donner, Geologist (Cambridge)
D. Masson-Smith, Geophysicist (Cambridge)
F. S. Plumpton, Organizer and surveyor (Oxford)
M. A. Rucklidge, Deputy Leader and medical officer (Oxford)
G. Tusa, Glaciologist (Oxford)
R. G. West, Botanist (Cambridge)

The expedition left Sheerness on 7 July in H.M.S. *Vidal*, Tromsø on 17 July in S.S. *Lyngen*, and Longyearbyen on 21 July in M.S. *Nordsyssel*, and returned to Gourock on 13 September in H.M.S. *Vidal*.

An area of fast ice on the south coast of Nordaustlandet made access to Bråsvellbreen impossible, so the expedition landed at Brageneset, a short distance from Vestfonna.

In addition to routine glaciological, geological and botanical investigations, the following work was carried out.

A Worden gravity meter was used for a series of measurements. Traverses were made along the coasts of Wahlenbergfjorden, on the east coast of Hinlopenstretet, and along a 20 km. profile of the Vestfonna. Measurements at these stations were related to those of the Russo-Swedish Arc of Meridian Expedition, 1899–1902.

Four thermal drilling stations were established, at the margin of the ice sheet at 33 m. above sea-level; in the crevassed and uncrevassed sections of the ablation area at 120 m. above sea-level; and in an area 350 m. above sea-level where the firn depth was approximately 6 m. Holes were drilled to depths of 87 m. and temperature profiles determined at each station.

At the ice margin the relation of till-stone orientation to ice movement was established. Measurements of ice movement and density were made, also an examination of raised beach levels, indicated by the distribution of pumice, in Hinlopenstretet.

On the return journey from Vestfonna some of the party disembarked at Agardhbukta and walked to Longyearbyen, later rejoining the remainder at Tromso.

R.A.F. ARCTIC TRAINING FLIGHTS, 1955

[Summarized from information provided by Air Commodore G. A. Walker. Previous reports of R.A.F. arctic training flights were given in the *Polar Record*, Vol. 6, No. 44, 1952, p. 474–83, 518 and 529–31, and Vol. 7, No. 50, 1955, p. 389.]

In May 1955 two Hastings aircraft of the Royal Air Force Flying College at Manby, Lincolnshire, made training flights from Resolute Bay, in Cornwallis Island, over the North Pole.

The aircraft left Keflavík, in Iceland, on 6 May and, passing close to Thule in North Greenland, arrived at Resolute some 9 hours later. Preparations for the polar sorties were delayed by bad weather, and the aircraft were not ready until 9 May. A

[1] An account of this expedition was published in the *Polar Record*, Vol. 6, No. 46, 1953, p. 800–03.

they were about to start an oil leak developed in an engine of one aircraft which had to be grounded until a spare part arrived from Winnipeg. The other aircraft flew three sorties on 9 and 10 May, and left for Winnipeg on the 11th. The same day the awaited spare part arrived and the second aircraft flew a sortie before following on to Winnipeg. The sorties to the North Pole and back to Resolute each took about 10 hours.

In June 1955 the Canberra bomber *Aries IV* carried out a trans-polar flight from Bardufoss, Norway, to Fairbanks, Alaska. The aircraft left Bardufoss at 20.00 hours, a time selected to ensure availability of sun/moon observations throughout the flight, and landed at Fairbanks at 02.30 hours, thus covering a distance of 3200 statute miles in 6 hours 30 minutes. Weather conditions were good over most of the route and the observed air temperature (at a mean flight altitude of 45,000 feet) varied between −45° and −35° C.

This was the latest in a series of flights designed to develop a technique of polar navigation suitable for high-flying jet aircraft. Earlier flights had been made in conditions of total darkness, where the astro situation was wholly favourable, and had been out-and-back flights; the trans-polar flight was thus a logical step forward, including day as well as night flying and following a point-to-point route.

VOYAGE OF THE *FEDOR LITKE*, 1955

[From *Vodnyy Transport* [*Water Transport*], 15 September 1955.]

The Soviet icebreaker *Fedor Litke*, carrying an oceanographical expedition in the waters north of Zemlya Frantsa-Iosifa, reached lat. 83° 11′ N., long. 49° 03′ E., on the night of 12–13 September 1955. This is believed to be the most northerly point reached by a ship under its own power. The *Fedor Litke*, which was commanded by V. I. Potashnikov, was launched at Barrow in 1909 as the *Earl Grey*.

Since 1938 the record has been held by another Soviet icebreaker, the *Iosif Stalin*, which attained lat. 83° 06′ N. in the waters north of Novosibirskiye Ostrova when trying to extricate the beset *Georgiy Sedov*. In North American waters, the U.S.C.G.C. *Eastwind* reached lat. 82° 38′ N., long. 61° 51′ W. in August 1952 just after taking supplies to the joint Canadian–U.S. weather station at Alert.

SOVIET DRIFTING STATIONS IN THE ARCTIC OCEAN, 1955

[From *Vodnyy Transport* [*Water Transport*], 16 April, 31 May, 16 June and 22 September 1955.]

Two Soviet drifting stations known as SP-3 and SP-4 were established on the ice of the Arctic Ocean in April 1954.[1]

SP-3 drifted to within 150 miles of the north coast of Greenland, and its personnel were evacuated by air on 20 April 1955. At that time it seemed likely that the station was going to start drifting clock-wise in a circle by heading westwards parallel to the Greenland coast, rather than continuing southwards and emerging in the East Greenland current.

The party manning SP-4 was relieved on 17 April 1955, when the station was at lat. 80° 53′ N., long. 175° 50′ W. The relief party, led by P. A. Gordiyenko, remains (December 1955) at the station. Drift has continued to be northerly.

At the same time as the evacuation and relief of SP-3 and SP-4 was being carried out, a new station, SP-5, was established at lat. 82° 04′ N., long. 157° 00′ E. The

[1] See *Polar Record*, Vol. 7, No. 50, 1955, p. 396–99.

party here is led by N. A. Volkov. The course of drift has been in general northerly with a considerable westward component in August and September.

The work performed has continued to consist chiefly of meteorological, oceanographical, magnetic and sea ice studies.

Contact with the mainland is maintained by heavy aircraft. The ice landing strips have had to be changed from time to time, when movement of the ice has rendered sites unusable.

The heavy lines show the course of the five Soviet drifting stations.

WHALE MARKING VOYAGE OF THE *ENERN* IN THE SOUTHERN OCEAN, 1954

[Summarized from a report by Johan T. Ruud and R. Ravninger in *Norsk Hvalfangst Tidende*, 1955, No. 6, p. 2–7. A note on the whale marking operations in 1953 appeared in the *Polar Record*, Vol. 7, No. 51, 1955, p. 495.]

The British and Norwegian companies engaged in pelagic whaling in the Antarctic in 1954–55 shared the cost of a one month's whale-marking expedition before the opening of the season. Marks and equipment were provided by the National Institute of Oceanography and Statens Institutt for Hvalforskning. The *Enern*, belonging to Messrs Thor Dahl, Ltd., was again used, with the captain, Martin Marthinsen, and the second gunner, Per Stokke, carrying out the chasing and marking. Improved marksmanship was achieved by mounting the barrel of the shot-gun, used for

marking, inside the barrel of the harpoon swivel gun, and 48 per cent of the marks shot hit their targets, compared to 39 per cent in 1953.

The *Enern* left Cape Town on 5 November 1954 and reached the ice edge at lat. 57° 27′ S., long. 43° 50′ E. on the 11th. Marking began next day and the vessel sailed west to lat. 58° 50′ S., long. 35° 50′ W. (in the Scotia Sea) then east to meet the factory ship *Thorshøvdi*, at lat. 57° 30′ S., long. 10° W. on 11 December. During the 28 days of the operation 243 whales were marked. On 10 February 1955, at lat. 60° 46′ S., long. 11° 23′ W. the gunner on the *Enern* recognized a Blue Whale which had been marked on 28 November 1954 at lat. 54° 12′ S., long. 16° 02′ E.

THE FALKLAND ISLANDS DEPENDENCIES SURVEY, 1953–54

[Summarized from information provided by the Colonial Office. Accounts of F.I.D.S. activities in 1950–53, and of the Falkland Islands and Dependencies Meteorological Service, were published in the *Polar Record*, Vol. 7, No. 48, 1954, p. 166–73; No. 51, 1955, p. 521–22. See map on p. 61.]

Relief of F.I.D.S. stations, 1953–54. The R.R.S. *John Biscoe*, Captain W. Johnston, left Southampton on 1 October 1953, carrying relief parties, stores and equipment. She reached Port Stanley, Falkland Islands, on 31 October, and left for her first southern voyage on 9 November. Among the passengers was G. Howkins, Chief Meteorological Officer of the Falkland Islands, who was to tour all the F.I.D.S. stations to check meteorological equipment and to discuss problems with the meteorological observers. The *John Biscoe* called at Admiralty Bay, King George Island, on 12 November to relieve the station, departing again on the 17th. She was at Deception Island from 17 to 27 November, and then returned to Admiralty Bay. On the 28th she joined the frigate H.M.S. *Nereide*, Commander P. R. H. Harrison, R.N., in the vicinity of Cape Melville, King George Island, where a party of eight Royal Marines, under the command of Major Edwards, R.M., were trans-shipped for duty at Deception Island. The *John Biscoe* returned to Deception Island, via Admiralty Bay, on the 29th.

During her first visit to Deception Island two surveyors, R. R. Kenney and N. A. G. Leppard, were put ashore in order to make a detailed map of the island. They began work towards the end of November, establishing camps at Collins Point and in Pendulum Cove, and working independently from these camps. The work continued until the end of February, and their map has since been published by the Directorate of Colonial Surveys at a scale of 1 : 50,000 (D.C.S. (Misc.) 217, first edition, 1955).

The *John Biscoe* relieved the F.I.D.S. stations at Port Lockroy on 30 November and at Hope Bay on 3 December. On 7 December she took K. V. Blaiklock, D. G. Stratton, A. J. Standring and R. J. F. Taylor from Hope Bay to Joinville Island, where they were to spend some weeks making a topographical survey of the group. The *John Biscoe* then visited the F.I.D.S. station on Signy Island on 9 to 12 December, the whaling stations in South Georgia on the 13th to 15th and Hope Bay on the 19th, returning to Port Stanley on 23 December.

Between 12 and 17 January 1954, the *John Biscoe* delivered a cargo of live sheep, meat and mail to the whaling stations in South Georgia.

The second southern voyage of the *John Biscoe* began with her departure from Port Stanley on 29 January. She visited Signy Island on 1 February, and then went to Joinville Island to take the survey party back to Hope Bay. The survey of the whole of Joinville Island was by this date successfully completed, and some observations of the adjoining islands had been made.

The *John Biscoe* left Hope Bay on 4 February, reached Port Lockroy the same day,

and made her first call of the season at the Argentine Islands station on the 5th. She remained there until 2 March, while new buildings were put up on Marina Point, Galindez Island, to replace the existing huts on Winter Island. When this task was under way, the *John Biscoe* made further calls at Port Lockroy on 3 March and at Deception Island on the 4th, returning to the Argentine Islands on the 5th. She finally left there on the 22nd, returning to Deception Island, via Port Lockroy, on the 24th.

The survey of Deception Island had meanwhile been completed and the two surveyors were transferred to Hope Bay. The *John Biscoe* made her final visits to Admiralty Bay on 24 March, to Hope Bay on 25 March, to Signy Island on 29 March and to South Georgia on 2 April. She made a tour of the South Sandwich Islands between 5 and 9 April, to look for evidence of foreign activities, but because of persistently bad weather no landings could be made. She returned to Port Stanley on 15 April and reached England towards the end of June.

Movements of British naval vessels, 1953–54. The movements of H.M.S. *Nereide* were restricted during the early part of the season by ice conditions. With Sir Miles Clifford on board, she visited the South Georgia whaling stations between 19 and 23 November 1953, and Signy Island on the 25th, returning to Port Stanley via Cape Melville on 1 December. During January 1954 she went twice to Deception Island, and on 30 January she visited Half Moon Island and Discovery Bay, Greenwich Island, both in the South Shetland Islands. She visited Deception Island between 31 January and 3 February, and again on 13 February, before returning to Port Stanley on the 15th to hand over her duties as guardship to H.M.S. *St Austell Bay*, Commander D. C. H. Ward, R.N.

The *St Austell Bay* left Port Stanley on 20 February 1954 for her first visit to Deception Island. Early in March it was announced that the Argentine Minister of Marine would visit antarctic detachments in the Argentine naval vessel *Les Eclaireurs*. The *St Austell Bay* was at once instructed to act as escort. The tour, which was completed without incident, included visits to Argentine detachments at Deception Island, Hope Bay, Half Moon Island, Potter Cove (King George Island), Paradise Harbour (Danco Coast) and the Melchior Islands. It was completed on 10 March. *Les Eclaireurs* returned to Argentina, and the *St Austell Bay* to Port Stanley which she reached on the 13th. She made one further visit to Deception Island on 20 March to relieve the party of Royal Marines which had been stationed there throughout the season, returning finally to Port Stanley at the end of the month via Grytviken, South Georgia.

Activities at F.I.D.S. stations, 1954. Routine meteorological observations were continued throughout the year at the seven occupied stations: Port Lockroy, Deception Island, Hope Bay, Argentine Islands, Admiralty Bay, Signy Island and Grytviken, South Georgia. In addition to the usual broadcasts of collective synoptic messages (FICOLS) from Stanley, special weather forecasts for the whaling fleets were made from Grytviken between 14 October 1953 and 25 March 1954.

Some biological work was undertaken at Signy Island.

The hut at View Point, Duse Bay, was re-occupied by members of the Hope Bay station on 9 March, for the purposes of meteorological work and sealing. In June, work was begun on a large-scale topographical survey of the vicinity of Hope Bay. Between 30 July and 19 August a party of four—W. Turner, Taylor, Standring and Leppard—carried a depot to a point on the ice shelf about eight miles south of Cape Longing on the east coast of Graham Land. Between 2 September and 6 October the same four men again travelled south. On this occasion the depot was moved on as far as Pedersen Nunatak in the Seal Nunataks. It was planned to sledge to the Evans Inlet area, using this depot to support the longer journey, but in fact this plan was not carried out until the following year.

Biological work in South Georgia, 1953–54. A party of two, B. Stonehouse and W. N. Bonner, reached South Georgia on 10 October 1953. On arrival, Bonner had his appendix removed in the hospital at Leith Harbour. Stonehouse, with a temporary assistant, went to the Bay of Isles on 29 October, and established a base in Ample Bay, where he was joined later by Bonner. In the early part of the summer season, the embryos of Gentoo Penguins (*Pygoscelis papua*) and King Penguins (*Aptenodytes patagonica*) were collected. Later the behaviour of various birds, especially penguins, was studied, and biological collections were made. This biological work was continued throughout the winter of 1954.

Appendix. *Wintering parties at F.I.D.S. stations, 1954*

Port Lockroy, Wiencke Island, Palmer Archipelago (*Base A*)

F. G. Bird, Officer-in-charge and scientific assistant
M. J. Faulkner, Scientific assistant
A. M. Swain, Wireless operator mechanic
R. H. Watton, Diesel electric mechanic
B. Weeks, General assistant (ionospheric)

Deception Island, South Shetland Islands (*Base B*)

G. E. Hemmen, Officer-in-charge and meteorological observer
D. C. G. Mumford, Wireless operator mechanic
D. Parsons, Meteorological assistant (senior duties)
L. J. Shirtcliffe, Meteorological assistant
J. E. Smith, Diesel electric mechanic

Hope Bay, Trinity Peninsula (*Base D*)

W. Turner, Officer-in-charge and medical officer
J. A. Barber, Wireless operator mechanic
G. H. Brookfield, Meteorological observer
I. W. N. Clarke, Meteorological observer
R. R. Kenney, Assistant surveyor
N. A. G. Leppard, Assistant surveyor
A. F. Lewis, Meteorological assistant (senior duties)
R. C. Mottershead, Meteorological observer
K. E. C. Powell, Diesel electric mechanic
A. Precious, Meteorological observer
A. J. Standring, Geologist
R. J. F. Taylor, Dog physiologist

Argentine Islands, west Graham Land (*Base F*)

R. A. Lenton, Officer-in-charge and wireless operator mechanic
R. J. Banks, Meteorological observer
H. J. Buckman, Wireless operator mechanic
F. D. Byrne, Meteorological assistant
A. N. Graham, Senior meteorological assistant
J. Raymond, Carpenter, general assistant
E. M. P. Salmon, Meteorological assistant
I. H. Simpson, Meteorological assistant
R. J. Tanton, Diesel electric mechanic
A. B. N. Widgery, Meteorological observer

Admiralty Bay, King George Island, South Shetland Islands (*Base G*)

D. J. George, Officer-in-charge and meteorological assistant (senior duties)
B. L. Golborne, Diesel electric mechanic
R. H. W. Nalder, Wireless operator mechanic
G. C. Rumsey, Meteorological assistant
R. L. Tapp, Meteorological assistant

Signy Island, South Orkney Islands (*Base H*)

H. Smith, Officer-in-charge and meteorological observer
P. A. Cordall, Meteorological observer
G. B. Davis, Wireless operator mechanic
J. B. Pearce, Diesel electric mechanic
A. A. Smith, Meteorological assistant (senior duties)

Grytviken, South Georgia (Base M)

D. Borland, Forecaster
J. Cochrane, Meteorological assistant
J. R. Cowling, Meteorological assistant
D. S. Hosie, Meteorological assistant

BRITISH SOUTH GEORGIA EXPEDITION, 1954–55

[Summarized from information supplied by G. A. Sutton.]

On 20 August 1954 a mountaineering expedition left Glasgow in the *Southern Opa* and reached Leith Harbour, South Georgia, on 30 September. Those taking part were

George A. Sutton, Leader
Ian M. Brooker, Medical officer
Richard A. Brown, Geologist
Harry Pretty, Surveyor
E. Clive Webb, Assistant surveyor

A base was established in the gaol at King Edward Point and attempts made t climb Mount Paget, the highest peak on the island. The first, by way of Nordenskjöl Glacier to the col south-east of the peak, was defeated by the severe nature of th icefall up to the col. A 4886 ft. peak was climbed during the attempt. The second, fo which the party were taken to Newark Bay on a sealer, was from the south side o Allardyce Range, but failed through lack of time as they had to return when calle for by the sealer.

Brown and Sutton later spent ten days climbing in the Cooper Bay area, an Brooker and Webb in the Royal Bay area, while Pretty examined a glacier on Moun Hodges, near King Edward Point.

The party left Leith Harbour on 1 April 1955 on the *Southern Opal.*

NOTES

THE INTERNATIONAL GEOPHYSICAL YEAR, 1957–58

[Summarized from information provided by Professor Sydney Chapman, F.R.S.]

The First and Second International Polar Years of 1882–83 and 1932–33 were organized mainly for arctic observations of magnetism, meteorology and aurora. Since 1933, however, there have been so many technical and theoretical advances in the study of the earth's atmosphere that a similar concentration of scientific effort was considered again desirable. The year 1957–58 was chosen as coinciding with a sunspot maximum (the Second International Polar Year coincided with a sunspot minimum) and, to mark the wider scope of the investigations, the enterprise was called the International Geophysical Year. The area to be covered includes the Arctic, Antarctic and the tropical belt, together with the meridians 70–80° W., 10° E., 110 and 140° E. At successive meetings of the organizing body, the Comité Spécial de l'Année Géophysique Internationale, forty-one nations have announced their intention to take part in the project.

Meteorology. The main objectives will be to study the general circulation of the atmosphere, and the interchange of heat, momentum, angular momentum and entropy between different parts of the globe. In the first Polar Year observations were made at the earth's surface; in the second the atmosphere was explored in height as well, and a major aim during 1957–58 will be to extend this exploration over a much greater part of the globe and to much higher levels than before. At the standard meteorological stations the height distribution of air temperature will be measured twice daily, and of wind four times daily, up to 20 km., and whenever possible, especially on the Regular World Days (three per month) up to 30 km. On the Regular World Days, when observations are to be specially intensive and widespread, temperature observations will be made four times daily. The use of rockets and earth satellites will extend the exploration of the atmosphere far above the heights attainable by meteorological baloons. Instruments and methods of observation and publication are to be standardized.

Geomagnetism. The chief geomagnetic problems for investigation are those relating to magnetic storms. The existing, and inadequate, number of observatories will be enlarged, and supplemented by magnetic recorders installed at ionospheric and cosmic ray stations. The increased number of tropical observatories will allow for fuller observation of the concentration of daytime electric current over, or near, the magnetic equator. Improved and more extensive recordings of magnetic pulsations and earth currents will be made.

Aurora. The International Geophysical Year is too brief an interval to afford much improvement in the long-range statistics of auroral frequency; but it should mark a great advance in the observation of the many auroræ expected to occur during that time. Stations in suitable areas will be equipped with automatic cameras to photograph the whole sky every few minutes during the

night; in some stations there will be automatic scanning spectrographs giving a succession of spectra of auroral light in the vertical meridian plane, and as wide as possible a network of visual observers will be organized in areas particularly in lower geomagnetic latitudes, where auroræ are less often visible.

Airglow and Zodiacal light. Airglow, the faint light emitted by the upper atmosphere, will be investigated at selected points by means of scanning photoelectric photometers, which automatically survey the entire sky at brief intervals throughout the night. Less complicated photometers will be used at other stations. Spectrographic and interferometric studies will be made at a few special stations; and some high-level spectral observations will be made from rockets. Auroral and zodiacal light, whenever present, will be investigated at the same time.

Cosmic rays. The main emphasis of the cosmic ray programme will be the investigation of geomagnetic, aeronomic and solar problems to which cosmic ray observations may be able to make a distinctive, perhaps unique, contribution. It will be the first occasion on which a prolonged simultaneous standardized scheme of world-wide cosmic ray observation will be operated, and it is hoped to record observations from a network of sixty stations. The two main types of instruments to be used are a counter telescope to record rays of relatively high energy, and a neutron-monitor for the low-energy part of the cosmic ray spectrum.

Solar observations. Because so many geophysical phenomena are related to solar activity, the sun will, so far as possible, be continuously observed during the year in the several different ways now available. Observing hours at solar observatories will be extended to give an overlap of observation periods at stations in different longitudes, and thus minimize breaks in the continuity of record due to possible cloudy weather. Records of sunspot numbers, prominences and faculæ will be supplemented by spectroscopic, spectrographic and photographic observations of solar flares, by spectrophotometric observations of the inner corona, and by records of solar radio emissions and their polarization, at a series of wave-lengths. Interferometric studies of the location of radio sources will be made, and rocket spectra at successive high altitudes will be photographed. Equipment at some observatories will indicate the beginning of solar flares, to enable special observations to be made outside normal "solar patrol periods".

The distribution of the line-of-sight component of the magnetic field of the sun will be mapped over the solar disk two or three times daily, at Mount Wilson and possibly elsewhere.

These solar observations will be of cardinal importance to the scheme of world notification of Alerts and Special World Intervals.

Ionospheric investigations. Ionospheric prediction stations will also play a vital part in the plan for Alerts and Special World Intervals. More than one hundred stations for the exploration of the ionospheric layers overhead, by vertical beams of pulsed radiation, are planned for standard ionospheric observations, in addition to a number of important special investigations.

Longitudes and latitudes. There will be new determinations of latitudes and longitudes, and of the variations of these quantities. One aim will be a more precise determination of the irregularities of the earth's rotation, and another aim will be corrections to star catalogues. In addition, a new method will be applied to determine the mutual relation of the geodetic networks covering the continents by frequent photography of the moon against the background of stars, from some twenty observatories. It is expected that this will reduce the errors of the estimates of the extent of the oceanic gaps between the networks from 200 to 300 ft., as now, to about 100 ft.

Glaciology. The extent, character and behaviour of glaciers and snow cover will be measured in many parts of the world. The investigation of the ice morphology and measurement of the total ice content of Antarctica are the most important objectives in this programme, and have special importance for the long-term climatological prediction of sea-level changes. The limits of permanent ice should be charted with considerable accuracy.

Oceanography. Survey vessels from several nations will co-operate in a plan to study water circulation, sediments and crustal structure, and heat exchange between sea and air, in addition to the customary oceanographical investigations and measurements. More than forty stations will be equipped with tide gauges and non-tidal long-wave recorders. The shifting boundary between temperate and arctic waters, and the warming of the Arctic, will be studied.

The oceanographical ships will also be available, as far as possible, as moving stations for other types of geophysical observations.

Seismic and gravity measurements. These will be made by expeditions on numerous antarctic and island sites not normally accessible.

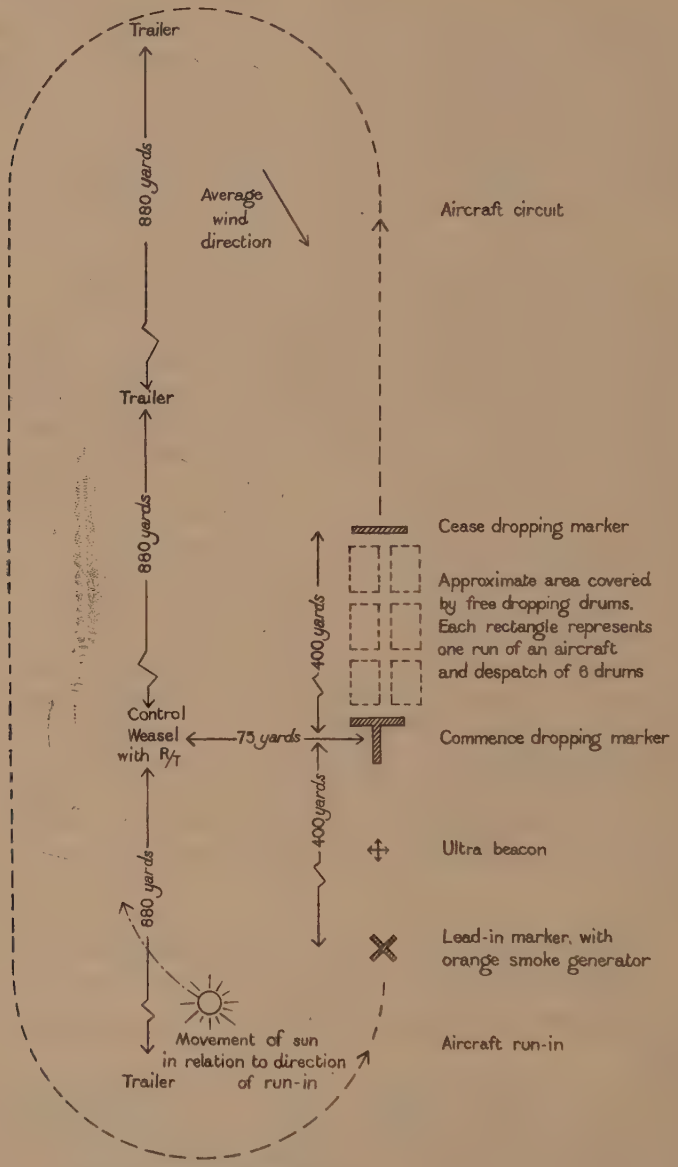
Rocket programme. The development of the rockets, and the high-speed measuring instruments they carry, are the most considerable advances in technique since the Second International Polar Year; by means of these instruments exploration of the atmosphere to heights of up to 20 km. is possible. The United States at present plans to use thirty-six large and a hundred smaller rockets during the period, and the French propose to use twelve large ones. The United States has also announced that it expects to launch some small earth satellites during the Geophysical Year.

TECHNIQUE OF AIR SUPPLY TO THE BRITISH NORTH GREENLAND EXPEDITION, 1952–53

[From information supplied by Major D. S. Barker-Simson. An article "The supply of expeditions by aircraft", by Paul-Emile Victor, appeared in the *Polar Record*, Vol. 7, No. 47, 1954, p. 24–31.]

In 1952 and 1953 Hastings C. mk II. aircraft of the R.A.F. Transport Command were used to drop supplies and fuel to the advance base of the British North Greenland Expedition at "Northice" and (in 1953) to the fuel dump at "West Point", both on the Greenland ice sheet. Supplies were sent by sea to Thule and flown on from the U.S.A.F. base there. The first drop took place on 15 September 1952, and 96 tons were dropped in thirty-six sorties. In 1953,

between 30 August and 11 September, 32 tons were dropped at "Northice" and 15 tons at "West Point", in thirteen sorties. The following notes are on the technique used in 1953, which was based on experience gained during the 1952 operations.



Layout of the dropping zone.

Method of navigation

Grid navigation and gyro-steering were used throughout the flights and astro fixes were taken, using the sun and moon for position lines. The astro compass was used for heading checks and for taking bearings of a mountain on the coast as long as it was visible. Drift readings were obtained whenever the surface was sufficiently irregular to get a recording. Homings were obtained very successfully from the Ultra beacon when the aircraft were close enough to "Northice".

Layout of dropping zone

The dropping zone consisted of a weasel and three trailers as markers in a line at half mile intervals on a true heading of 300°; this kept the aircraft headed into the prevailing wind, and with the sun behind it, during its low-level runs. The markers were in the order trailer-weasel-trailer-trailer, with the R/T equipped weasel serving as a control tower. A "T" of red fluorescent nylon material, 75 ft. across the top and 75 ft. along the stem, was laid 75 yd. to the right of the weasel. At a distance of 400 yd. beyond the "T", and parallel to its crossbar, was laid a "cease dropping bar" of the same material, also 75 ft. long. A "lead-in marker", consisting of a 30 ft. cross, also of red fluorescent nylon, was laid 400 yd. short of the "T". An Ultra beacon was placed half way between the "lead-in marker" and the "T". Smoke generators were lit on the "lead-in marker" whenever visibility was poor, and gave off a dense cloud of orange coloured smoke for seven minutes.

Technique of dropping supplies

The stores dropped to the expedition in 1952 and 1953 were as follows:

	1952	1953
Fuel (free dropped)	12,000 gallons	10,000 gallons
Supplies (free dropped)	14 tons	—
Supplies (parachute)	12 tons	3 tons

In 1952 all fuel had been dropped in jerricans, with a resulting loss of 19 % due to damaged containers. In 1953, 55-gallon drums were used, filled with 45 U.S. gallons (38 Imperial gallons) of fuel, leaving a 10-gallon air space which would compress on impact and prevent the drums bursting. There were 261 of these drums and they were dropped six at a time from 50 ft. at an air speed of 125 knots. In 1952, trials had been made using the normal aircraft roller conveyor for despatching the fuel and other items. This proved unsatisfactory for various reasons, so ejector boards were used from both port and starboard doors. These were used for all drops except the larger pieces of equipment such as hut sections, weasel tracks, etc. which were manhandled through the open double door. However, these ejector boards were not suitable for dropping the drums used in 1953 so a special drum ejector was made. This resembled a drayman's chute and was built to fit across the fusilage leading to each side door of the aircraft; it was long enough to hold three drums at a time, secured by a trigger device and a strop. Each aircraft carried two drum ejectors. The normal ejector boards were still used for stores other than drums.

In both years fragile scientific equipment and stores were packed in boxes and dropped by parachute from 400 ft. Nylon parachutes were used in 1953, because in 1952 cotton ones had, owing to dampness, frozen in the air and failed to open. The greater part of the supplies (other than fuel) were packed in strong jute sacks and padded with wood wool. These were dropped from 50 ft., as were the drums, which resulted in the sacks hitting the snow with forward momentum, thereby using the snow as a decellerator. In 1952 the complete hut for "Northice" was dropped in 6 ft. × 4 ft. sections by parachute. In addition, there were some items of over 600 lb. such as a complete weasel engine, a generator set, spare weasel tracks and calor gas cylinders. The last two were dropped with complete success.

Before leaving Thule each day the altimeter subscale reading was adjusted to read the current barometric pressure with the aircraft on the runway. Altimeters were compared, and a note made on the difference between their readings and the correct height. As the aircraft approached the dropping zones the men on the ground set their altimeters to read 8000 ft. (the correct height was unknown) and read off the subscale readings to the aircraft captains, who set the same readings on their altimeters. Applying the correction found at Thule, they then used 8000 ft. as their datum height from which to free drop. A preliminary run in at 200 ft. was made and the aircraft's height was assessed by the ground party and by the captains in relation to the weasel. The safest and most accurate free-dropping technique was achieved by starting the circuit at 400 ft. and the actual approach at a minimum of 300 ft. Power was then reduced slowly on all four engines at a steady rate of descent, which brought the aircraft down to 50 ft., with an air-speed of 125 knots, at the lead-in marker. In order to avoid any turn and wing-lowering at low levels it was found essential to line the aircraft up with the dropping zone. The co-pilot called out the height every 50 ft. down to 100 ft. and then every 10 ft. during the drop and return to 100 ft.; then every 50 ft., back to 400 ft. Height being almost impossible to judge over the snow, the operation required the utmost concentration, and the co-pilot constantly cross-checked both sets of flying instruments. Twenty minutes before arriving at the dropping zone the two parachute doors were removed and the ejectors fixed in position. The despatchers were given four minutes warning at the beginning of each circuit to load six drums in position on the ejectors. On the final run-in to the dropping zone the navigator gave a one-minute warning, then the drums were released and pushed down the chute at a signal from the supply aimer in the nose of the aircraft. A safety delay between each drum prevented them from colliding in the snow and bursting. This method proved most successful; the drums came to rest on the surface of the snow about 15 ft. beyond the point of impact and, out of the 261 drums dropped, only 3 broke open, showing a loss of less than 120 gallons out of a total of 9918 gallons. A load of drums was normally dropped in four runs. The parachuting of loads weighing 120 to 150 lb. was equally successful, and was made simultaneously from port and starboard parachute doors at 400 ft.

Comparison with French technique

The most important difference between this technique and that used by the French in Greenland in 1949–51 is in the method of the control of the aircraft when approaching the dropping zone to drop loads. In the French system instructions about the direction, speed, and height of the incoming aircraft were given from the control weasel by an experienced controller, or by a controller sitting between the pilot and co-pilot; in the British system these details are worked out by the air crew themselves. The containers in which loads are dropped also differ. The French used jerricans for free-dropping of fuel, and boxes packed with wood-wool into larger boxes for parachute droppings; the British used heavy drums for free-dropping fuel and strong jute sacks for other stores. Free-drops were made by French aircraft at from 20 to 30 ft. but the R.A.F. found that results were entirely satisfactory from the safer height of 50 ft.

DANISH TOPOGRAPHICAL MAPS OF GREENLAND

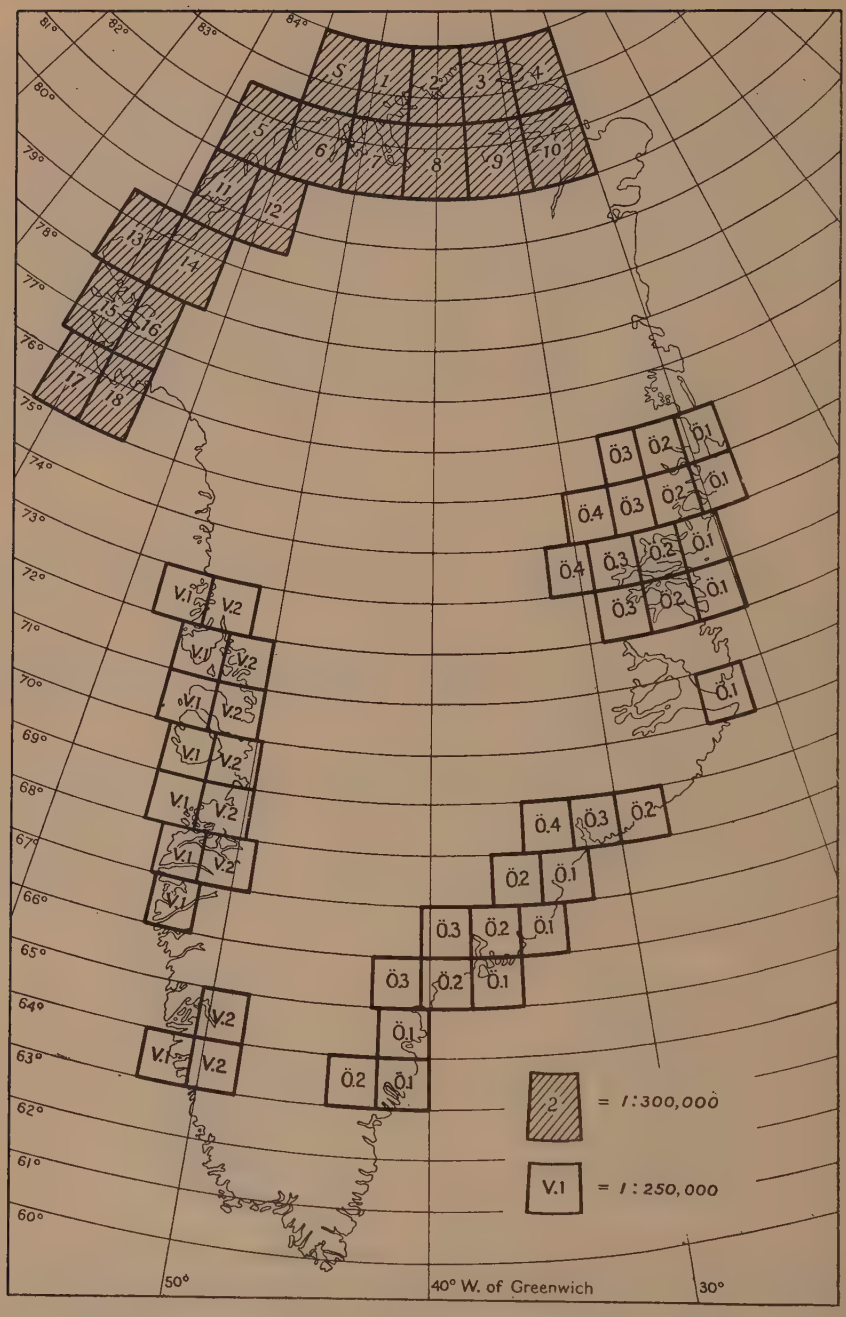
[Based on information in *Geodætisk Instituts Kort* (catalogue) and *Geodætisk Institut. Publikationer. Liste*, nr. 11–27, 1939–55.]

The Danish Geodætisk Institut issues topographical maps of parts of Greenland on scales of 1 : 300,000, 1 : 250,000, 1 : 50,000 and 1 : 2000. There is also available a map of the whole of Greenland on a scale of 1 : 5,000,000, of which new editions appear from time to time.

The maps on a scale of 1 : 300,000 are nineteen in number, making up a set called *Map of North Greenland. . . surveyed by Lauge Koch in the years 1917–23.* (Price 250 Danish kroner.) Relief is shown by green and brown shading and by spot heights. Land ice is shaded with purple, and sea ice is indicated by blue and white symbols. The area covered by the sheets is shown on the plan, with sheet names as follows:

1 Beaumont Island
2 Lockwood Island
3 Cape Morris Jesup
4 Cape Bridgman
5 Hall Land
6 Black Horn Cliff
7 Wulff Land
8 Adam Biering Land
9 Navy Cliff
10 Danmark Fjord
11 Cape Constitution
12 Petermann Glacier
13 Etah
14 Cape Agazis [*sic*]
15 Cape Parry
16 Inglefield Gulf
17 Cape Atholl
18 Cape York

The 1 : 250,000 maps are Geodætisk Institut's main series. The survey which is their basis has been described by Professor N. E. Nørlund, director of the Institut, in the *Polar Record*, No. 17, January 1939, p. 38–42. Relief is shown by a combination of brown contours at 50 m. intervals, spot heights, dark green colouring for low-lying ground, merging into fawn for high ground, and



Sheet lines of the 1:250,000 and 1:300,000 maps of Greenland.

graduated dark brown hill shading. Land ice is shown white, with purple contours (continuations of the brown land contours) and purple hill shading. Rivers are dark blue, sea and lakes light blue, and other features black. Lettering is dark blue or black. The general impression made by these maps is very pleasing, and the colour registration is perfect. Slight modifications have been made in the style of some of this series, especially in sheets of West Greenland recently issued. For example, layer tinting in dark green and pale fawn without hill shading has been adopted. Provisional editions of some of the sheets have been issued, without coloured hill shading. Each sheet (covering about 12,000 km.) spans one degree of latitude. It is designated by the latitude figure of the southern sheet line with V. or Ö. to indicate West or East Greenland respectively, and a number. Most sheets are based on surveys made between 1931 and 1934, and in 1937, but sheets 63 V.1, 63 V.2 and 64 V.2 were surveyed between 1947 and 1949 and corrected in 1951. The price is 3 Danish kroner per sheet. Sheets issued so far are shown on the plan. A key is given below.

63 V. 1 Færingehavn
63 V. 2 Fiskenæsset
64 V. 2 Kapisigdlit
66 V. 1 Holsteinsborg
67 V. 1 Nordre Strömfjord Vest
67 V. 2 Nordre Strömfjord Öst
68 V. 1 Egedesminde
68 V. 2 Christianshaab
69 V. 1 Godhavn
69 V. 2 Jakobshavn
70 V. 1 Nûgssuaq
70 V. 2 Umanak
71 V. 2 Svartenhuk
71 V. 2 Uvkusigssat
72 V. 1 Upernavik
72 V. 2 I.P. Kochs Land

63 Ö. 1 Skjoldungen
63 Ö. 2 Skirners Bjærge
64 Ö. 1 Umîvik
65 Ö. 1 Angmagssalik
65 Ö. 2 Graahs Öer
65 Ö. 3 Pikiutdleq
66 Ö. 1 Steenstrups Bræer
66 Ö. 2 Schweizerland
66 Ö. 3 Helheim
67 Ö. 1 Kruuses Fjord
67 Ö. 2 Kronprins Frederiks Bjærge
68 Ö. 2 Kap Garde
68 Ö. 3 Kangerdlugssuaq
68 Ö. 4 Kangerdlugssuaqs Gletscher
70 Ö. 1 Scoresbysund
72 Ö. 1 Kap Parry
72 Ö. 2 Kong Oscars Fjord
72 Ö. 3 Nathorsts Land
73 Ö. 1 Hold With Hope
73 Ö. 2 Ymers Ö
73 Ö. 3 Petermanns Bjærg
73 Ö. 4 Hvidbjörns Nunatakker
74 Ö. 1 Wollaston Forland
74 Ö. 2 Clavering Ö
74 Ö. 3 Ole Römers Ö
74 Ö. 4 Wilkins Nunatakker
75 Ö. 1 Hochstetters Forland
75 Ö. 2 Kong Wilhelms Land
75 Ö. 3 Carlsbergfondets Land, Sydl. Del.

The maps of the 1 : 50,000 series are based on the 1 : 250,000 sheets. Land-ice slopes are shaded pale blue, and sea and lakes are light blue; all other features are in black. Each sheet of the 1 : 250,000 series is divided into sixteen sheets on a scale of 1 : 50,000—four horizontal rows of four sheets—each one being designated by the main map's number followed by a letter from A to Q, beginning with A in the north-west corner. The letter I is omitted. Only

sheets on which there is land are issued. The following sheets have been published:

64 V. 1 A–Q
64 V. 2 A, B, E–Q
65 V. 1 F, K, L, P
66 V. 1 A–Q
67 V. 1 A–Q
67 V. 2 A–Q
63 Ö. 1 B, C, E–G, J–L, N
64 Ö. 1 A–G, J–L, N–P
64 Ö. 2 H
65 Ö. 1 A–G
65 Ö. 2 B–L, N, O
65 Ö. 3 P, Q
66 Ö. 1 C, D, G, J, K, N
66 Ö. 2 H–Q
66 Ö. 3 H, M, Q
67 Ö. 1 K, N, O

Finally, maps of a number of the settlements in Greenland (Kolonikort) have been issued on a scale of 1 : 2000. All are based on post-war surveys. They are printed in nine colours: blue, two shades of green, yellow, orange, purple, grey, black; and brown for contour lines at 2 metre intervals. Sixteen have been published:

Christianshaab
Egedesminde
Færingehavn
Frederikshaab
Godhavn
Godthaab
Holsteinsborg
Jakobshavn
Julieanehaab
Kangamiut
Nanortalik
Narssaq
Qutdligssat
Sukkertoppen
Umanak
Upernavik

CANADIAN TRANS-POLAR COMMERCIAL FLIGHTS, 1955

[Summarized from an article by J. H. Crump in *Spanner* (journal of the Canadian Pacific group of companies), June 1955, p. 11–13.]

On 3 June 1955 the Canadian Pacific Airlines' Super DC-6B *Empress of Amsterdam* left Vancouver for the first flight of a commercial air service across the north polar regions to Amsterdam. The aircraft was piloted by Chief Pilot Ralph B. Leslie and carried forty-three passengers including the New Zealand Minister of Tourist Development, the Lord Mayor of Sydney, and representatives of the U.S. and Canadian government and press.

A landing was made at Søndre Strømfjord in West Greenland for re-fuelling, and the aircraft reached Amsterdam at 10 a.m. on 4 June. The flight of 4825 miles took just over eighteen hours' flying time; it is about 1000 miles shorter than the trans-Atlantic route but saves more time proportionately to this distance by avoiding congested airports and by taking advantage of the better flying conditions in the Arctic. By means of this route, and the Canadian Pacific Airlines' service to Australia and New Zealand, those countries are brought within three days' flying time of Europe. At present the service is a weekly one.

Slipway of *Willem Barendsz.*

Dutch whale factory ship *Willem Barendsz* (*see note on p.* 46).

Photographs by courtesy of Wilton-Fijenoord

(*Facing p.* 42)

Helicopter rescues an aircraft.

TENTH AIR RESCUE GROUP, U.S. AIR FORCE

[Summarized from information supplied by Colonel John L. Parker, Commander, 10th Air Rescue Group.]

The Air Rescue Service of the U.S. Air Force was formed in 1946, and has Rescue Groups and Squadrons stationed along the airlines of the world most frequently travelled by U.S. Air Force aircraft. The 10th Air Rescue Group is responsible for operations on the mainland of Alaska; it has no aircraft of its own, but supervises the activities of two assigned squadrons.

Three types of aircraft are used by these squadrons, the S.A.-16 Albatross, the SC-54, and the H-19 helicopter. The first of these is equally capable of service on hard-surface runways, water, snow and ice, and the second is used for long-range operations. Each squadron, in addition to normal staff, includes medically trained paratroops, and is fully equipped with survival gear.

Although primarily designed for the rescue of airmen, the service has carried out a large number of civilian rescues.

THE ALASKA PIPELINE

[Summarized from information supplied by the Office of Public Information, Department of Defence, Washington.]

The Alaska Pipeline runs from Haines to Fairbanks, a distance of 626 miles, and was built to provide safer and cheaper movement of liquid fuels to Alaska, by shortening the previous land and sea route by some 200 miles. Work on the project was begun in December 1953 with clearing operations which continued throughout the winter, and on the pipeline itself, and the five pumping stations, in April 1954. The pipe used was a low carbon, seamless, steel line pipe, with an outside diameter of $8\frac{5}{8}$ in., and thicknesses of 0·27 in. and 0·31 in. It has a capacity of 12,000 barrels per 24 hours and is buried for 122 miles of its length.

RESCUE OF AN AIRCRAFT BY HELICOPTER

[Based on information supplied by Squadron-Leader R. T. Heaslip, 108 Communications Flight, R.C.A.F.]

A Piasecki H-21 helicopter of the 108th Communications Flight, R.C.A.F., carried out an unusual rescue operation in April 1955, in the Chibougamau area of Quebec Province. A ski-equipped Cessna 180 aircraft, owned by a commercial company, was reported to have landed on an unnamed lake 55 miles west of Chibougamau, and to be sinking through the ice surface, unable to take off.

A party were landed from the helicopter and built a platform of spruce trees on the edge of the lake, on which it could stand while preparations were being made to move the aircraft. The ice on the lake was by then so thin and rotten that it was only possible to walk on it in snowshoes, and it took two hours to rig up a sling round the aircraft. When this was ready the helicopter hovered and was hooked on to the sling; it then eased the aircraft out of the ice and carried it to a landing strip 18 miles away.

MARKING BISON FROM THE AIR

[Summarized from information provided by the Chief of the Canadian Wildlife Service.]

Wood Buffalo National Park was established by the Canadian Government in 1922, to provide sanctuary for the remnants of the Wood Bison (*Bison bison athabascae*) population of northern Canada. The reserve covers some 17,000 square miles of Alberta and the Northwest Territories. The bison have responded well to protection, and now number about 15,000.

Only one-quarter of the reserve provides suitable winter range, a fact which has some bearing on the migrations of the numerous small herds into which the bison are grouped. In order to add to the present scanty knowledge of these migrations, it was decided in 1954 to mark individuals in some of the herds.

Ordinary marking methods—by corralling, and branding or painting—were out of the question, both because of the size and wildness of the animals and because of the remoteness of the wilderness which they inhabit. Mr W. A. Fuller, mammalogist of the Canadian Wildlife Service, devised the idea of spraying the bison from a helicopter, using a hand fire pump. Sheep-marking paint, diluted with turpentine to avoid clogging, was used, and on two days during August 1954, Mr R. C. Stewart, assistant to Mr Fuller, marked eighty-five bison—thirty-five with red paint, thirty with green, and twenty with blue.

Many difficulties were encountered. The door of the helicopter had to be removed in order to use the sprayer. For effective marking, the helicopter had to hover within 5 ft. of the animal, which naturally panicked. It was found that the best method was to chase the bison until it stood still from exhaustion before spraying it. In open prairie country this was quite feasible, but where there were trees in the neighbourhood the frightened animals took cover and were not easily approached again. Gusty winds—coupled with the speed of running bison—added to the difficulty and danger of low flying and increased the tendency of the paint-spray to blow back into the cabin through the door, drenching and choking the operator and pilot. Clogging of the sprayer, perhaps because turpentine was not a suitable thinner for the paint used, also gave some trouble. Bright red paint, although nearest to the colour of the bison themselves, was found to show up better than green or blue; blue was the least visible colour. On an average, one gallon of thinned paint was enough to mark about twenty animals, allowing for a number of misses. The total flying time occupied in marking eighty-five animals was about four and a half hours.

SEVENTH MEETING OF THE INTERNATIONAL WHALING COMMISSION, 1955

[Summarized from *Norsk Hvalfangst-Tidende*, No. 8, 1955, p. 469–72.]

The seventh meeting of the International Whaling Commission was held in Moscow from 18 to 23 July 1955 at the invitation of the Soviet Government. All seventeen contracting governments[1] were represented with the exception

[1] Australia, Brazil, Denmark, France, Great Britain, Iceland, Japan, Mexico, Netherlands, New Zealand, Norway, Panama, South Africa, Sweden, U.S. and U.S.S.R.

of Brazil. Dr Remington Kellogg (U.S.), whose chairmanship had come to an end after a term of three years, was succeeded by Dr G. J. Lienesch (Netherlands), and Mr R. G. R. Wall (Great Britain) was elected vice-chairman in place of Dr Lienesch.

The Commission recommended the following amendments to the Schedule to the 1946 Convention (which contains whaling regulations):

(*a*) The Blue Whale unit quota should be reduced by 500 to 15,000 for the season 1955–56, and thereafter by a further 500.

(*b*) The date for the opening of the Blue Whale season should be changed from 21 January to 1 February.

(*c*) The areas in the Pacific sector (roughly the area south of lat. 40° S. between longs. 70° W. and 160° W.), which had been closed for some years, should be opened for three years.

These amendments were not unanimously agreed and must be approved by contracting governments before they come into force.

It was decided to ask the depository governments to proceed with the amendment of the 1946 Convention, by means of a protocol, so that helicopters and other aircraft could be brought within the jurisdiction of the Convention. It was also decided to deal in the same way with the question of inspection which cannot be dealt with by an amendment of the Schedule.

The Commission also considered a proposal, put forward by the Norwegian Commissioner, for placing on board each factory ship an observer of a different nationality from the flag of the ship, in addition to the existing inspectors required under the Convention.

Attention was called to the objections raised by the Danish and Icelandic governments to the proposal, which emerged from the Tokyo meeting, prohibiting for a period of five years the taking of Blue Whales in the North Atlantic. At the same time a similar prohibition relating to Blue Whales in the North Pacific, which was passed at the Tokyo meeting, and subsequently came into force except against certain objecting countries, was rescinded.

The sum of £1000 was set aside for whale marking activities.

CLASSIFICATION OF SHIPS FOR USE IN ICE

The following suggestions are made for classification of ships to be used in ice.

(1) **Icebreakers.** These are specially designed ships with the following characteristics: strongly-built hull with wedge-shaped bow, short and broad, small cargo space, and a ratio of horse-power to normal displacement of one, or more than one, to one. There is no established classification of icebreakers, so the following is suggested:

(*a*) Heavy icebreakers (Russian *lineynyy ledokol* = capital icebreaker), of 10,000 h.p. or more. Examples: *Yermak*, *Stalin*-class, *Wind*-class, *Kapitan Belousov*.

(*b*) Auxiliary icebreakers (Russian *vspomogatel'nyy ledokol* = auxiliary icebreaker), of about 4000 to 10,000 h.p. Examples: *Litke*, *Sisu*, *C. D. Howe*, *General San Martín*.

(*c*) Port icebreakers (Russian *reydovyy* or *portovyy ledokol* = port icebreaker), of 2000 h.p. or less. These are in fact tugs designed to assist ships into and out of ice-bound harbours. Examples: *Otso*, *Isbjørn*.

(2) **Ice strengthened ships.** These may either be ships specially designed for polar work, or ordinary freighters with strengthening added. The best classification of such ships is that laid down by the Finnish Sjöfartsstyrelsen [Board of Navigation], which lists six classes of "ice-worthiness".[1] The first four of these (IA, IB, IC, and IIA) demand requirements over and above the normal classifications such as 100 A1 at Lloyd's, and equivalent notations by other insurers. The Lloyd's notation "strengthened for navigation in ice" is the equivalent of the Finnish IC. The Finnish classification, however, has been drawn up with the Baltic in mind rather than the much tougher ice of the Arctic or Antarctic regions.

Ice strengthened ships may be specially designed for ice (Russian *ledokol'nyy parokhod* = icebreaking ship). These will generally be in Finnish category IA or stronger. Examples are *Sedov*, *Norsel* and *Kista Dan*. On the other hand they may have strengthening added, as in the case of *Stalingrad* and *John Biscoe*.

THE DUTCH WHALE FACTORY SHIP *WILLEM BARENDSZ*

[Summarized from information provided by N. V. Dok-en Werf my. "Wilton-Fijenoord", Schiedam.]

The *Willem Barendsz* was built by the N. V. Dok-en Werf my. "Wilton-Fijenoord" at Schiedam for the Nederlandse Maatschappij voor de Walvisvaart N.V., Amsterdam, and launched in November 1952. With a displacement of about 44,000 tons, and a dead-weight of about 26,500 tons, she is the largest factory ship in the world, and can also be used as a tanker. She has a length of 205 m., a breadth moulded of 27·5 m., a depth moulded of 19 m. and a draught, fully loaded, of 10·7 m. There are two Wilton-Fijenoord M.A.N. 2-stroke reversible diesel engines, each developing 5250 e.h.p., and giving a speed of 14 knots. Eight Scottish oil fired boilers develop the steam required for the factory, the electric power plant, the auxiliaries and heating of the oil tanks and domestic heating. Two 40-ton winches are used to haul the whales on deck. (See photographs facing p. 42.)

ICE ISLANDS OFF EAST GREENLAND

[Information contained in a letter dated 28 September 1955 from Knud Lauritzen to G. Hattersley-Smith.]

A large ice island was sighted from M.S. *Kista Dan* in Kong Oscars Fjord on 20 September 1955. It appeared to be stationary in about lat. 72° 05′ N. long. 23° W. The surface was 2 to 3 m. above sea-level, and as far as could be seen from the ship, it was practically level. The ship's radar showed that the area of the ice island was about 50 sq.km. A smaller ice island was passed the following day off Scoresbysund.

[1] *Istjänsten i Finland*. Helsingfors, Havsforskningsinstitutet, 1937, p. 55–59.

RECENT ICEBREAKER CONSTRUCTION

[Based on articles in the *Journal of Commerce. Shipbuilding and Engineering edition*, 27 January 1955, by A. C. Hardy, and in *Marine Rundschau*, Heft 4, 1954, p. 125–29.]

In the last three years there has been a sharp increase in the construction of icebreakers. Details are given below of the ships built.

Name of ship	Flag	Date of completion	Total normal displacement (tons)	Overall length (m.)	Moulded beam (m.)	Draft (m.)	Screws fore/aft	Propulsion	Speed (knots)	Total power shaft horse power (s.h.p.) indicated horse power (i.h.p.) or not specified	Builder
Elbjörn	Denmark	1953	1,400	51·0	12·0	4·9	1/1	Diesel electric	12?	2,400	Frederikshavn
Thule	Sweden	1953	1,930	62·3	16·1	4·9	1/2	Diesel electric	14	5,040	Karlskrona
D'Iberville	Canada	1953	9,930	94·5	20·3	9·0	–/2	Steam	16	10,800 i.h.p.	Levis, Quebec
Labrador	Canada	1954	6,040	82·3	19·2	9·1	–/2	Diesel electric	16·6	10,000 s.h.p.	Marine Industries, Sorel
*Voima**	Finland	1954	4,415	83·5	19·4	6·4	2/2	Diesel electric	16	8,750	Wärtsila-Koncernen AB, Helsingfors
Kapitan Belousov†	U.S.S.R.	1954	5,360	83·5	19·4	5·8	2/2	Diesel electric	16	9,750	Wärtsila-Koncernen AB, Helsingfors
General San Martín	Argentina	1954	4,500	84·7	18·6	6·5	–/2	Diesel electric	17·5	6,600	A. G. Weser Werk, Bremerhaven
Glacier	U.S.A.	1955	8,300	94·5	22·5	—	–/2	Diesel electric	14?	21,000 s.h.p.	Ingalls, Pascagoula
[Unnamed]‡	U.S.S.R.	Under construction	12,840	118·9	24·5	9·5	–/3	Diesel electric	19	22,000 s.h.p.	Wärtsila-Koncernen AB, Helsingfors

* A ship of similar design but rather bigger (about 5,000 tons displacement and 11,000 h.p.) is being built for Sweden.
† Two others in this class are being built for the U.S.S.R.
‡ Another ship in this class is to be built for the U.S.S.R.

SOVEREIGNTY IN THE FALKLAND ISLANDS DEPENDENCIES

In an attempt to settle the Antarctic dispute the United Kingdom made unilatera applications to the International Court of Justice at The Hague on 4 May 1955, and invited the Argentine and Chilean Governments to accept the jurisdiction of the Court.

The following are the texts of the letters addressed to the Registrar of the International Court of Justice on 15 July and 1 August respectively by the Chilean Minister and the Argentine Ambassador at The Hague, and of the reply by Sir Gerald Fitzmaurice, Agent for the Government of the United Kingdom, dated 31 August

Letter from the Minister of Chile at The Hague to the Registrar of the International Court of Justice

(Translation)
Legation of Chile
The Hague
(No. 202)

Republic of Chile,
Ministry for Foreign Affairs
The Hague, 15 July 1955

Sir,

I have the honour to refer to the note which you were good enough to address to the Minister for Foreign Affairs of Chile on May 6th last, with reference to an Application to the International Court of Justice by the Government of the United Kingdom of Great Britain and Northern Ireland, relating to the sovereignty over certain Antarctic territories.

My Government has instructed me to inform you in reply of the following:—

As appears from the above-mentioned Application itself, the Government of Chile has on various occasions officially and explicitly indicated to the Government of the United Kingdom that recourse to the International Court of Justice cannot be applicable in the case of the Chilean Antarctic, a territory in which my country exercises its sovereignty in full and absolute form.

This attitude was re-affirmed to the British Embassy in Santiago de Chile in Note No. 4272, sent by the Ministry for Foreign Affairs of Chile on May 4th, 1955, the day on which the United Kingdom filed the Application to which reference has been made above. Since this Note repeats the arguments previously expressed by my Government as the basis for its refusal to consent to the reference of this question to the International Court of Justice, I consider it opportune to set forth here the contents of this Note.

It is in the following terms:—

"The Ministry for Foreign Affairs presents its compliments to her Britannic Majesty's Embassy and has the honour to refer to Note No. 1521/264/54, dated December 21st last.

In that communication, the Embassy first recalls that Her Majesty's Government has on previous occasions drawn the attention of the Government of Chile to the terms of the Letters Patent of 1908 and 1917 relating to the so-called Dependencies of the Falkland Islands; it then notes the fact that the Government of Chile has persistently maintained that certain regions of such Dependencies form part of the Chilean territory.

The Embassy at the same time refers to the suggestions formulated by the British Government to the effect that Great Britain and Chile, together with the Republic of Argentina, should submit their claims to sovereignty for the decision of the International Court of Justice, a suggestion which had not met with the necessary response. Her Majesty's Government, expressing regret at this attitude

now enquires whether the Government of Chile, as an alternative, would be prepared to refer, jointly with the Government of Great Britain, to an *ad hoc* arbitral tribunal its claims in respect of the territories designated as Dependencies of the Falkland Islands in the Letters Patent of 1908 and 1917.

The Note of the British Embassy concludes by stating that, if this proposal should not be favourably received by the Chilean Government, Her Majesty's Government would consider itself at liberty to take such steps as might be open to it to obtain recognition of its rights by the International Court of Justice.

In reply, the Ministry for Foreign Affairs has the honour to state that, although the Government of Chile prides itself on a long-standing tradition of respect for the principle of submitting to arbitration tribunals controversies of a legal character, such a method of peaceful settlement cannot be applied in the specific case of a part of the national territory in which Chile exercises full and absolute sovereignty in virtue of unimpeachable titles of a juridical, political, historical, geographical, diplomatic and administrative character. The mere assertion by a foreign country of claims to this part of the territory of Chile cannot suffice to give rise in that territory to a litigious situation which impairs Chile's conviction that she has possessed and continues to possess complete sovereignty over these territorial areas.

Notwithstanding the fact that the titles invoked above are sufficient in themselves irrefutably to establish the sovereignty of Chile, the Ministry for Foreign Affairs considers it relevant further to remind Her Britannic Majesty's Government that the region of the Antarctic Continent subject to the sovereignty of Chile was considered by the Conference for the Maintenance of Continental Peace and Security, which met at Rio de Janeiro in 1947, to be essential for the protection of the hemisphere; furthermore, the Treaty of Reciprocal Assistance, signed at Rio de Janeiro directly following that Conference, includes it in the Zone of Security of America, provided for in Article 4. The Government of Chile accordingly feels wholly unable to become a party to any proceedings of a judicial or arbitral character with any extra-continental country that affect or may affect territories which have been considered by all American countries as fundamental for the defence and the security of the Continent.

Furthermore, the proposal of Her Britannic Majesty's Government affects another Power which is directly interested—the Argentine Republic—with which Chile is bound, by a Joint Declaration of March 4th, 1948, to act by common accord with regard to the protection and the juridical defence of the South American Antarctic comprehended between the meridians 25° and 90° longitude west of Greenwich, in which territories both countries recognise each other's unquestionable rights of sovereignty.

In setting out the reasons which prevent the Government of Chile from consenting to arbitration or judicial settlement with regard to its Antarctic territory, the Ministry for Foreign Affairs would take this opportunity of adding its express reservations with regard to the legal force or juridical value of the Letters Patent of 1908 and 1917, on which Her Britannic Majesty's Government bases its claims to the said territory.

In view of the foregoing, the Government of Chile greatly regrets that it is not in a position to accept the suggestions of Her Britannic Majesty's Government. At the same time, it believes that it will be making a useful contribution to the interests of science and to the use of the Antarctic regions for the benefit of humanity by expressing its willingness to participate in the conclusion of an agreement of limited duration between those countries which have a genuine interest in the Antarctic Continent, in order to make possible by permanent and friendly co-operation scientific explorations and investigations which will permit

the advancement of the knowledge and use of these regions, without thus involving recognition or any alteration of the juridical status of exclusive dominion or other rights of which each of the participating States may at this time consider itself in legitimate possession.

The Government of Chile ventures to hope that a period of co-operation and co-existence, based on mutual respect, in the Antarctic regions will be conducive to valuable contributions to science and to the use of natural resources and will at the same time prevent friction and resentment between countries which, like Chile and the United Kingdom, are bound by traditional ties of friendship which the Government of Chile is most anxious to maintain.

Finally, while the Chilean Government is unable to perceive the true scope of the claim of the United Kingdom that the International Court of Justice can unilaterally grant recognition of its rights, the Ministry for Foreign Affairs considers it necessary to express at once the most formal and unequivocal reservation as to the jurisdiction of this high organ to adjudicate upon this question of sovereignty in the absence of the express consent of the Government of Chile.

The Ministry for Foreign Affairs avails itself of the opportunity to reaffirm to the Embassy of Great Britain the assurances of its very high and distinguished consideration.

Santiago, May 4th, 1955."

For all these reasons, my Government considers it pointless to undertake to deal with the arguments put forward in the British Application which are exclusively based on the theory of discovery, the exercise of unfounded acts of administration and the promulgation of Letters Patent applicable to a territory over which Chile had already established its dominion by virtue of unimpeachable titles of an historical, juridical, political, geographical, diplomatic and administrative character.

My Government consequently will confine itself on this occasion to stating that the Application of the Government of the United Kingdom is unfounded and that it is not open to the International Court of Justice to exercise its jurisdiction in this case.

I avail myself of the opportunity to renew to you, Sir, the assurances of my distinguished consideration.

(Signed) LUIS RENARD

Letter from the Ambassador of Argentina at The Hague to the Registrar of the International Court of Justice

(Translation)

Embassy of the Republic of Argentina

V. No. 93

The Hague, 1 August 1955

Sir,

With reference to your communication No. 22078 bis of May 6th last, relating to the claim presented by the United Kingdom Government concerning its pretensions to certain Antarctic territories, I have the honour to inform you that I have been authorised by the Argentine Government to furnish as a reply to the said claim the following Note which I set out hereunder:

"Ministry for Foreign Affairs and Public Worship

Buenos Aires, July, 1955

Sir,

With reference to your letter of May 6th, 1955, in which you informed me that the Government of the United Kingdom of Great Britain and Northern Ireland had submitted an Application to the International Court of Justice on the fourth

day of the same month and year against my country, with regard to certain Antarctic territories, I have the honour to state the following.

As is recalled in the Application of the United Kingdom Government itself, to which reference is made, the Argentine Government has several times had occasion to indicate in notes addressed to Her Britannic Majesty's Embassy in Buenos Aires that it cannot consent to the question of sovereignty over the Antarctic territories of Argentina which it is sought to raise being referred for decision to any international Court of Justice or Arbitration Tribunal. By this present Note, my Government reaffirms its refusal in the most express way with regard to the jurisdiction of this Court and with regard to any possibility that it should be seised as such to deal with this case.

The Argentine Government feels itself obliged to make this declaration, by virtue of the fundamental principle in accordance with which territorial sovereignty cannot be submitted for discussion or be put in issue, especially when, as in the case of the Argentine Republic with regard to its Antarctic sector, that sovereignty is based on unquestionable rights and on titles derived from and based on legitimate methods of acquiring territorial domain, and effective, notorious and peaceful possession.

There are, moreover, equally decisive further reasons which prevent the Argentine Republic from accepting the means of settlement proposed by the United Kingdom. These reasons, like those previously referred to, have at the proper time been made clear on a number of occasions to that country in the diplomatic Notes to which I have referred and especially in that dated May 4th, 1955, which was handed in to the British Embassy in Buenos Aires on the same day as the United Kingdom Government submitted its Application to the International Court of Justice. I append as an Annex a true copy of that Note. The Argentine Government therefore considers that the United Kingdom Government's claim to be entitled to raise this question as one capable of being resolved by the Court is unfounded. It accordingly reaffirms what it has said before, to the effect that there are no reasons which would justify any decision by the Court with regard to this matter.

I avail myself, &c.
(Signed) JERONIMO REMORINO"

I have, &c.
(Signed) NATALIO CARVAJAL PALACIOS

Letter from the Ambassador of Argentina at The Hague to the Registrar of the International Court of Justice

(Translation)

Embassy of the Republic of Argentina — V. No. 94
The Hague, 1 August 1955

Sir,

I refer to my letter V. No. 93 of to-day's date and have the honour to transmit to you herewith, as an Annex and for your information, a copy of a Note No. 675, D.S.T., of May 4th last, in which His Excellency the Minister for Foreign Affairs and Public Worship of the Republic of Argentina replied to Her Britannic Majesty's Embassy on the subject of the question relating to the rights over Argentine Antarctic territories claimed by the United Kingdom.

I have, &c.
(Signed) NATALIO CARVAJAL PALACIOS

Note from the Ministry for Foreign Affairs of the Argentine Republic to the British Embassy in Buenos Aires

(Translation)
Ministry for Foreign Affairs
and Public Worship D.S.T.
(No. 675)

The Ministry for Foreign Affairs and Public Worship presents its compliments to Her Britannic Majesty's Embassy and refers to Note No. 314 of December 21st last, in which, with reference to the question relating to the rights over Argentine Antarctic territories claimed by the United Kingdom, Her Majesty's Government, after having reiterated its opinion to the effect that the most satisfactory method of resolving this problem would be to refer it for decision by the International Court of Justice at The Hague, asks whether, as an alternative to this course, the Argentine Government would be prepared jointly with the United Kingdom to refer "to the decision of an independent *ad hoc* arbitral tribunal the question of their respective rights under international law to the territory designated by the Letters Patent of 1908 and 1917 as Dependencies of the Falkland Islands."

2. The Letters Patent of 1908 and 1917, on which the British Government places so much reliance in support of the rights which it invokes, constitute from the point of view of international law acts or measures which are totally ineffectual as a basis for sovereignty, having regard to the fact that they are exclusively unilateral and that they were in no way agreed to by the Argentine Government.

3. It should be added that the basis of these documents is an absolutely false one, since the territories therein referred to and declared to be British are under the sovereignty of the Argentine Republic. The Falkland Islands, together with the lands in our Antarctic sector, are Argentinian, as are the South Georgia and South Sandwich Islands. This follows, as is well known to Her Majesty's Government, from legal bases not open to discussion. Further confirmation and proof thereof are to be found in well-known historical reasons and geographical factors which constitute irrefutable foundations for these rights by reason of their physical and permanent condition and which furthermore cannot possibly be invoked by Great Britain.

But Her Majesty's Government settles this question of substance and, acting as though the whole could be reduced to a single aspect, mentions as the only problem requiring a solution that which relates to the Antarctic territories which Great Britain claims and describes as Dependencies of the Falkland Islands. On the other hand, it says nothing about the fundamental problem of sovereignty over the latter.

4. In the face of such an attitude, the Argentine Government must, in the first place, emphasize that, if this relation of dependency really existed, it could not be relied upon by Great Britain. The reason is that the Falkland Islands—the main element in this purported relationship of dependency—being themselves Argentinian, the Antarctic territories which, as asserted by the United Kingdom Government itself, are dependencies thereof, must obviously and necessarily belong to the Argentine Republic. Quite apart from this fact, it is necessary to stress the uninterrupted possession maintained by the Argentine Republic in its Antarctic sector for more than fifty years, a situation which cannot be invoked by any other State, so far as permanent occupation is concerned.

5. It must also be pointed out that it is impossible to present a correct statement of the problem to which Her Britannic Majesty's Embassy refers without saying something of the occupation under which the United Kingdom holds the Falkland Islands. So long as the aggression committed by the usurpation of their possession remains unremedied by the restoration of this archipelago to the Argentine Republic, the Argentine Government cannot regard or accept as an amicable or legal one any

proposal based on the continuance of such usurpation. Still less can it agree that it is possible to base such usurpation on rights to sovereignty over other Argentine territories, which would result in the latter being affected by the consequences of the aggression suffered by the Falkland Islands. Such a situation cannot give rise to any right in favour of Great Britain.

6. Consequently, so long as the preliminary question referred to above is not settled in the way indicated, there is no justification for proposing, as the United Kingdom has done, that the case should be referred to the International Court of Justice at The Hague or to an *ad hoc* Arbitration Tribunal.

7. It is also appropriate to point out that, even if the British occupation of the Falkland Islands had not occurred or had come to an end, there would still be no reasons justifying the reference to arbitration proposed by Her Majesty's Government. This inevitably follows from the fundamental fact that the territories of the Antarctic sector, the rights to jurisdiction over which it is desired to refer to the decision of a court or an arbitration tribunal, are subject to the sovereignty of the Argentine Republic.

No legal or moral rule obliges States to submit for the decision of foreign powers or bodies their territorial rights based on legal titles, such as those which establish the unquestionable sovereignty of the Argentine Republic over its Antarctic sector and the adjacent islands.

This is an undoubted principle which is followed and respected by all nations. It is moreover confirmed by the fact that almost all those States which have acceded to the compulsory jurisdiction of the International Court of Justice at The Hague have made the appropriate reservation to exclude from their acceptance of this jurisdiction any possibility that they should be subject to the Court's decision as to the legality of their territorial rights. This is the case of the United Kingdom itself, which excluded, in addition to disputes which had arisen before 1930, those relating to questions within its own exclusive jurisdiction.

8. It is also necessary to stress the transcendental scope of this problem, to the extent that it concerns territories which, while Argentinian, are at the same time American. As such, they are covered by the provisions adopted in America by the twenty States which declared the whole of the continent and its maritime extension referred to in the Reciprocal Assistance Treaty of Rio de Janeiro as essential for the defence of the hemisphere. This eliminates any possibility of discussion before any international tribunal with regard to the sovereignty of an American country over territories comprised within this geographical zone.

Furthermore, consent to the arbitration proposed by Her Majesty's Government would be incompatible with the desire of the people and the Governments of this continent, who at the Tenth Inter-American Conference at Caracas, confirmed their will that the colonial system should be finally ended. These same states have reiterated their solidarity with all just claims in respect of territories occupied by extra-continental States.

With regard to the boundaries of the South American Antarctic area, it should be added to the reasons given above that the Argentine Government has, by the joint Declaration of March 4th, 1948, agreed with the Republic of Chile to ensure in concert the legal defence of the sovereignty belonging to the two countries within the area of their respective sectors where there is an overlap.

9. The Argentine Government consequently regrets that it cannot agree to the case referred to by the United Kingdom Embassy being submitted for decision to the International Court of Justice at The Hague or to any other court or arbitration tribunal.

With regard to the statement made by Her Majesty's Government to the effect that "it will consider itself free to take any steps open to it to seek a decision of the

International Court of Justice as to its legal rights," the Argentine Government declares that it reserves its right to reject any intervention whatsoever by any tribunal of which it has not previously accepted the jurisdiction and that it will also, for its part, constantly defend its rights by means which legally belong to the Argentine Republic as a sovereign State within the framework of the existing structure of the international community.

The Ministry for Foreign Affairs and Public Worship avails itself, &c.

Buenos Aires, 4 May, 1955

Letter from the Agent for the Government of the United Kingdom to the Registrar of the International Court of Justice

Foreign Office,
London, S.W. 1,
31 August 1955

Sir,

I have the honour, by direction of Her Majesty's Principal Secretary of State for Foreign Affairs, to refer to your letters of August 3rd, 1955, enclosing certified true copies of letters to yourself from the Argentine and Chilean Ambassadors at The Hague, relative to the United Kingdom Applications, filed on May 4th, 1955, instituting proceedings against Argentina and Chile respectively, in view of the illegal claims of these two countries to, and encroachments on, British territory in Antarctica. It will be convenient for present purposes to deal with both Applications together, and with both the sets of letters, copies of which were transmitted by you.

2. The United Kingdom Government is bound to regard these letters as amounting to a rejection of the jurisdiction of the International Court of Justice for the purposes of the present case. This rejection is a matter of keen regret, both on general grounds, and because an acceptance of the jurisdiction of the Court would have provided a solution, long and patiently sought on the United Kingdom side, to a dispute the continuance of which cannot fail to disturb the good relations otherwise subsisting between all concerned.

3. The United Kingdom Government was, of course, aware from previous correspondence that the Argentine and Chilean Governments were reluctant to submit the question of the validity of their claims in Antarctica to any form of international arbitration or adjudication. It was hoped, however, that, in the face of a specific application to the International Court, which includes a Judge of Argentine nationality, and which for a great many years, and until very recently, included one of Chilean nationality, the two Governments would reconsider the matter, and would decide to accept the jurisdiction of the Court in reference to a dispute so eminently calling for judicial settlement. The United Kingdom Government feels bound to observe that the action of these two Governments in continuing their encroachments in British Antarctica, while at the same time persistently rejecting every proposal for a settlement, and for the determination of the question of title involved, is difficult to reconcile with the letter and the spirit of the Charter of the United Nations, by which all the Governments concerned are bound.

4. Again, while not questioning the technical right of the Argentine and Chilean Governments to refuse to consent to a reference to the International Court, the United Kingdom Government finds it impossible to regard the reasons given for this refusal as being either satisfactory or convincing. Appeal is made, for instance, to some supposed "fundamental principle in accordance with which territorial sovereignty cannot be submitted for discussion or be put in issue." The existence of any such principle is, however, entirely negatived by the numerous decisions that have been given by international tribunals on disputed questions of territorial

sovereignty, of which those mentioned in paragraph 38 of the United Kingdom Application in respect of Argentina, and paragraph 36 of the Application respecting Chile, are only a very few, amongst a large number. It may be pointed out that the International Court itself, in the recent case of the *Minquiers and the Ecréhos*, heard and determined disputed claims to sovereignty of far greater antiquity than anything relating to Antarctica; and that in the *Eastern Greenland* case, the former Permanent Court of International Justice heard and determined a case not only involving claims of even longer standing than those in the *Minquiers* case, but one that related to regions of precisely the same physical and geographical character as those at present in question, and situated at approximately the same distance from one of the Poles. It is therefore impossible to regard the present dispute (which, equally, is essentially of a juridical nature) as not being suitable for settlement by judicial means, or as inappropriate for reference to the International Court.

5. It is apparently also suggested, in one form or another, that the validity of the Argentine or Chilean title, as the case may be, is too self-evident to require any judicial determination. That this is far from being the case is, however, clear, not only from the detailed statement of facts in support of the United Kingdom title given in its Applications in the present case (and which the Argentine and Chilean Governments only meet with generalities and bare affirmations, unsupported by any concrete evidence)—but also from the significant fact that a major part of the disputed territories is claimed by *both* Argentina and Chile, and on exactly the same grounds. Even, therefore, if the prior United Kingdom title were left out of account (based though it is—and as the claims of Argentina and Chile are not—on acts of possession, administration and control carried out long before any dispute as to sovereignty arose), it would be clear that neither the Argentine nor the Chilean claim could be regarded as self-evidently good, or as not requiring any judicial consideration.

6. Finally, it appears to be suggested that the Argentine and Chilean claims do not require investigation, because historical and geographical considerations alone give a title to each country—a point of view that fails to explain how it is that both sets of claims—based on the same grounds—can be valid in respect of what is largely the same territory. Even if this were ignored however, and even leaving out of account the constant emphasis placed by international tribunals on the necessity for a concrete and continuous display and exercise of actual sovereignty, the United Kingdom Government could not accept claims based on a supposed historical successorship to Spain, in respect of territories that were themselves never at any time Spanish, or even known to exist until their discovery by British explorers. As regards geographical factors, even if these could be admitted as relevant at all, it would not be possible to regard them as having any bearing on the title to territories situated from 500 to 1,000 miles away from the nearest points in Argentina and Chile, and some 2,000 or more miles from the respective capitals. It is sufficient, in relation to those matters, to refer first, to the pronouncement of the International Court in the case of the *Minquiers and the Ecréhos* (I.C.J. Reports, 1953, p. 57), to the effect that—

> "What is of decisive importance, in the opinion of the Court, is not indirect presumptions deduced from events in the Middle Ages, but the evidence which relates directly to the possession of the . . . groups";

and, in the second place, to refer to the finding of Judge Huber in the *Island of Palmas* case (Report in "American Journal of International Law," Vol. 22 (1928), p. 893) that—

> ". . . it is impossible to show the existence of a rule of positive international law to the effect that islands . . . should belong to a State from the mere fact that its territory forms the *terra firma* (nearest continent or island of considerable size). . . . The principle of contiguity . . . as a rule establishing *ipso jure* the

> presumption of sovereignty in favour of a particular State...would be in conflict with what has been said as to territorial sovereignty...[over] a region, and the duty to display therein the activities of a State. Nor is this principle of contiguity admissible as a legal method of deciding questions of territorial sovereignty; for it...would...lead to arbitrary results";

and again (p. 910)—

> "The title of contiguity, understood as a basis of territorial sovereignty, has no foundation in international law."

7. In conclusion, the United Kingdom Government wishes to draw specific attention to the fact that the concrete activities of Argentina and Chile in the Antarctic, and the acts of possession relied on by those countries in support of their claims, are for the most part of very recent date, and subsequent to the "critical dates" on which the respective disputes crystallized. These acts, moreover, as pointed out in the United Kingdom Application, were clearly undertaken not merely "with a view to improving the legal position of the Party concerned"—(*Minquiers* case, p. 59)—but for the express purpose of founding claims that did not rest on any basis of a previous concrete display or exercise of sovereignty; nor could they have done, since the existing British title would have rendered any such display illegal and void, both previous to the dates concerned, as well as subsequently.

8. Consequently, in accordance with what has now become an accepted principle of international law (*Palmas*, *Eastern Greenland* and *Minquiers* cases), the acts referred to in the first sentence of the previous paragraph cannot in any case count towards the establishment of title, and must be excluded from consideration by an international tribunal. *A fortiori* will this be so as regards any acts undertaken now or in the future, after a formal submission of the case to the International Court has been made, but frustrated by a refusal to submit to the jurisdiction on the part of the Party whose acts are in question. It follows that although, in the opinion of the United Kingdom Government, no Argentine or Chilean acts could have any validity after the date when the British title was established, it must at least be the case that, subsequent to the dates when the dispute crystallized—namely, 1926 (Argentina, in respect of South Georgia), 1937 (Argentina in respect of all the remaining territories in dispute), and 1940 (Chile, in respect of most of the same remaining territories)—the acts of these two countries regarding the territories concerned were wholly null and void, and cannot serve either to found, or to afford evidence of title. This applies equally, and indeed *a fortiori*, to future acts. Consequently, it must be placed on record that the refusal by the Argentine and Chilean Governments to agree to a reference of the matter to the Court can lead to no improvement in their legal position.

9. The United Kingdom Government also wishes to place on record its view that, having regard to the proposals previously made by it, and described in paragraphs 40 and 41 of its Application in respect of Argentina, and paragraphs 38 and 39 of the Application respecting Chile, it has now taken all the steps open to it to bring about a peaceful and amicable determination of the question of sovereignty, and that it can admit no responsibility for such consequences as may ensue from the continuance of the dispute, due to the rejection by the other two Parties to it of all proposals for a settlement, coupled with a persistent process of illegal encroachment on the British territories concerned.

10. I shall be grateful if you will communicate copies of this letter to the Members of the Court, and also to the Argentine and Chilean Ambassadors at The Hague.

I have, &c.

G. G. FITZMAURICE

STATIONS AND DEPOT HUTS IN THE FALKLAND ISLANDS DEPENDENCIES (EXCLUDING SOUTH GEORGIA), 1955

[Compiled by Brian Roberts and Ena Thomas, September 1955. Stations have been continuously occupied since establishment unless otherwise indicated. Numbers of occupants are given only for the years in which these are known. For map see p. 61. A previous list for 1953 was published in the *Polar Record*, Vol. 7, No. 48, 1954, p. 227–30.]

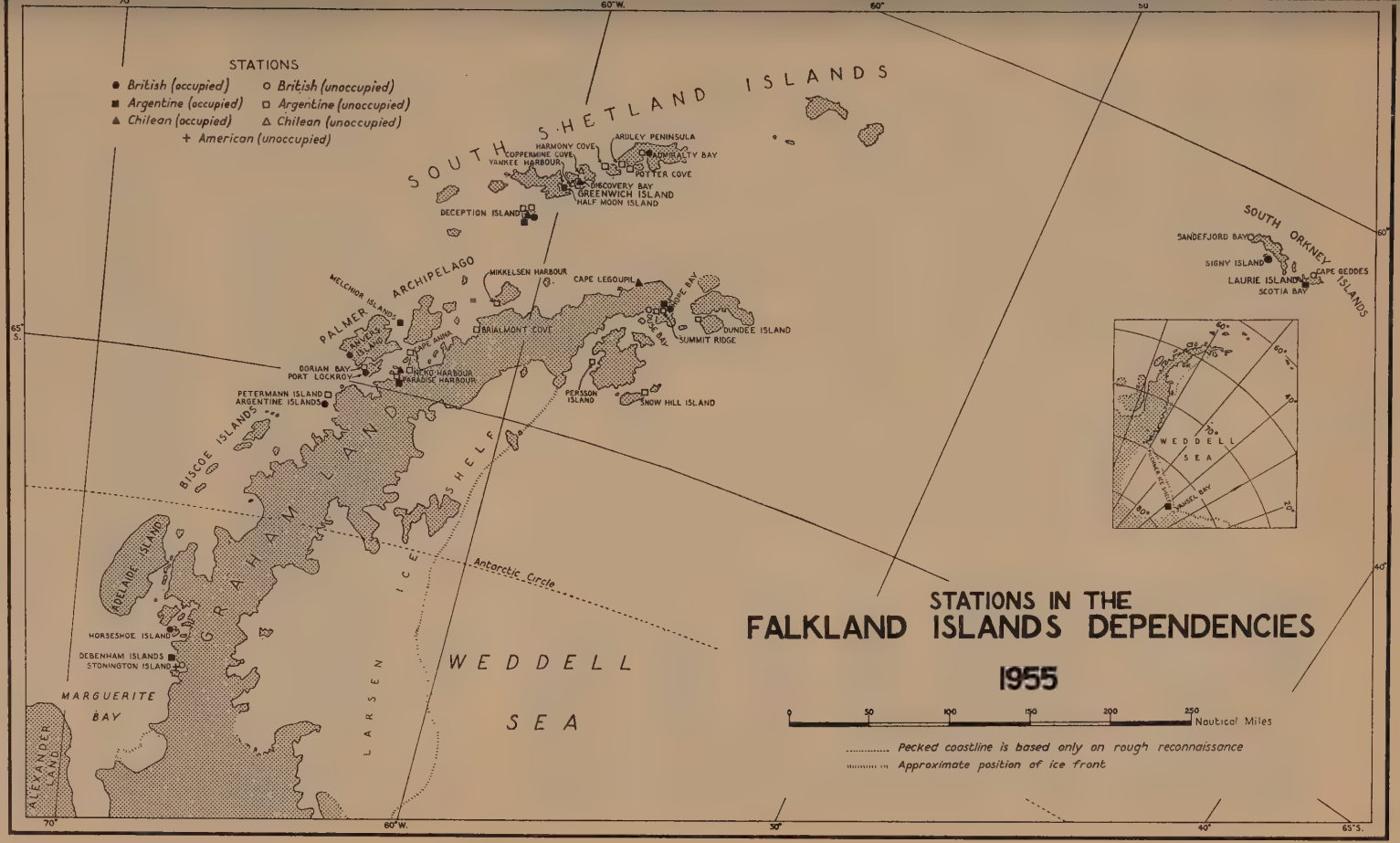
BRITISH

Locality	*Date established*	*Notes*
Goudier Islet, Port Lockroy, Wiencke Island, Palmer Archipelago (Base A) (lat. 64° 50′ S., long. 63° 31′ W.)	11 February 1944	8 men wintered in 1944; reduced to 4 men in February 1945; evacuated 8 April 1947; reoccupied by 2 men on 23 January 1948; increased to 5 men in winter 1948; evacuated in mid-February 1949; reoccupied by 4 men on 24 January 1950; evacuated 13 February 1951; reoccupied by 5 men on 15 December 1951; reduced to 4 men in winter 1955
Whalers Bay, Deception Island, South Shetland Islands (Base B) (lat. 62° 59′ S., long. 60° 34′ W.)	6 February 1944	4 men wintered in 1944; increased to 5 men in April 1947; reduced to 4 men in winters of 1948–51; increased to 6 men early in 1952; reduced to 5 men in winters of 1953 and 1954; increased to 6 men in winter 1955
Cape Geddes, Laurie Island, South Orkney Islands (Base C) (lat. 60° 42′ S., long. 44° 34′ W.)	22 January 1946	4 men wintered in 1946; evacuated 17 March 1947
Hope Bay, Trinity Peninsula (Base D) (lat. 63° 24′ S., long. 56° 59′ W.)	12 February 1945	13 men wintered in 1945; reduced to 8 men in January 1946; increased to 9 men in April 1947; reduced to 7 men in winter 1948; hut destroyed by fire 8 November 1948; evacuated 4 February 1949; station re-established by 11 men on 4 February 1952; reduced to 10 men in winter 1953; increased to 12 men in winter 1954; number maintained up to present time
Stonington Island, Marguerite Bay, Fallières Coast, west Graham Land (Base E) (lat. 68° 11′ S., long. 67° 00′ W.)	24 February 1946	10 men wintered in 1946; increased to 11 men in April 1947; evacuated 12 February 1950
Marina Point, Galindez Island, Argentine Islands, off Graham Coast, west Graham Land (Base F) (lat. 65° 15′ S., long. 64° 16′ W.)	14 February 1935	Hut built on Winter Island by British Graham Land Expedition and occupied until 17 February 1936; reoccupied by 4 men of F.I.D.S. on 9 January 1947; increased to 5 men in winter 1951; reduced to 4 men in winter 1952; increased to 5 men in winter 1953. New hut built on Galindez Island by F.I.D.S. in 1953–54 and occupied by 10 men in winter 1954; reduced to 9 men in winter 1955
Admiralty Bay, King George Island, South Shetland Islands (Base G) (lat. 62° 05′ S., long. 58° 25′ W.)	25 January 1947	2 men wintered in 1947; evacuated 23 March 1947; re-occupied by 5 men on 18 January 1948; increased to 6 men in winter 1949; reduced to 4 men in winter 1950; increased to 5 men in winter 1951; number maintained up to present time

Locality	*Date established*	*Notes*
Signy Island, South Orkney Islands (Base H) (lat. 60° 43′ S., 45° 36′ W.)	14 March 1947	4 men wintered in 1947; reduced to 3 men in winter 1948; increased to 4 men in winter 1949; increased to 5 men in winter 1950; increased to 7 men in winter 1955
North-west of Biscoe Bay, Anvers Island, Palmer Archipelago (Base N) (lat. 64° 45′ S., long. 64° 05′ W.)	28 February 1955	6 men wintered in 1955
Horseshoe Island, Marguerite Bay, Fallières Coast, west Graham Land (Base Y) (lat. 67° 49′ S., long. 67° 17′ W.)	11 March 1955	8 men wintered in 1955
Barry Island, Debenham Islands, Marguerite Bay, Fallières Coast, west Graham Land (lat. 68° 08′ S., long. 67° 07′ W.)	29 February 1936	Hut built by British Graham Land Expedition and occupied until 12 March 1937; repaired by F.I.D.S. in 1946, but not reoccupied; destroyed by Argentines, probably in about March 1951
Sandefjord Bay, Coronation Island, South Orkney Islands (lat. 60° 37′ S., 46° 01′ W.)	12 February 1945	Large hut erected, but not occupied
View Point, Duse Bay, Trinity Peninsula (lat. 63° 32′ S., long. 57° 24′ W.)	8 February 1953	Hut occupied intermittently by Hope Bay personnel for meteorological work and sealing
	ARGENTINE	
"Orcadas", Scotia Bay, Laurie Island, South Orkney Islands (lat. 60° 45′ S., long. 44° 43′ W.)	1904	This meteorological station has been continuously maintained since Dr Bruce, of Scottish National Antarctic Expedition, invited 4 Argentine scientists to operate it, starting 22 February 1904; 7 men wintered in 1948; 11 men in 1950 and 1953; probably 9 men in 1955. Manned, since 1951, by naval personnel
"Melchior", Gamma Island, Melchior Islands, Palmer Archipelago (lat. 64° 20′ S., long. 62° 59′ W.)	31 January 1947	9 men wintered in 1947; probably 8 men in 1948; 10 men in 1951; 11 men in 1953; probably 10 men in 1955. Manned by naval personnel
"Primero de Mayo", Port Foster, Deception Island, South Shetland Islands (lat. 62° 59′ S., long. 60° 42′ W.)	20 November 1947	10 men wintered in 1948, 1949 and 1950; increased to 11 men in 1951–54; probably reduced to 10 men in 1955. Manned by naval personnel
"Almirante Brown", Paradise Harbour, Danco Coast, west Graham Land (lat. 64° 53′ S., long. 62° 52′ W.)	1949–50 season	Unoccupied in 1950; 4 men wintered in 1951; station partially destroyed by fire during that year; rebuilt January 1952; 5 men wintered in 1952 and 1953; probably 7 men in 1955. Manned by naval personnel
"General San Martin", Barry Island, Debenham Islands, Marguerite Bay, Fallières Coast, west Graham Land (lat. 68° 08′ S., long. 67° 07′ W.)	8 March 1951	6 men wintered in 1951; 20 men in 1952 and 1953; 4 men in 1954; 10 men in 1955. Manned by army personnel

Locality	*Date established*	*Notes*
'Esperanza", Hope Bay, Trinity Peninsula (lat. 63° 24′ S., long. 56° 59′ W.)	Mid-December 1951	5 naval men wintered in 1952; 15 naval and army men wintered in 1953. Station extended in 1953–54 to accommodate separate naval and army detachments; about 9 naval and 15 army men wintered in 1954; probably 9 naval and 15 army, air force and civilian men in 1955
'Teniente Camara" (or "Teniente Canepa"), Half Moon Island, Moon Bay, Livingston Island, South Shetland Islands (lat. 62° 36′ S., long. 59° 57′ W	1951–52 season	Probably occupied for summer only in 1951–52; occupied by wintering party (probably 6 men) in March 1953; probably 8 men wintered in 1955. Manned by naval personnel
'General Belgrano", Filchner Ice Shelf (lat. 77° 59′ S., long. 38° 44′ W.)	4 January 1955	Size of 1955 wintering party not known
Admiralty Bay, King George Island, South Shetland Islands (lat. 62° 05′ S., long. 58° 25′ W.)	January 1948	Small hut erected; occupied temporarily by 2 men for one month only in 1948
'Teniente Jubany", Potter Cove, King George Island, South Shetland Islands (lat. 62° 13′ S., long. 58° 42′ W.)	27 January 1948	Small refuge hut found, unoccupied, by F.I.D.S. party in August 1949; possibly rebuilt in 1951–52; extended in 1953–54 and again in 1954–55, and occupied during both summer seasons. In December 1954–January 1955, an air unit, with flying boats, was temporarily based there
Neko Harbour, Andvord Bay, Danco Coast, west Graham Land (lat. 64° 49′ S., long. 62° 37′ W.)	9 March 1949	Refuge hut and meteorological observatory; possibly occupied temporarily in summer 1949–50; destroyed in 1951; rebuilt early in 1952; again occupied temporarily in summer 1954–55
'Thorne", Telefon Bay, Deception Island, South Shetland Islands (lat. 62° 56′ S., long. 60° 42′ W.)	23 March 1949	Unoccupied refuge hut; destroyed in 1951; rebuilt early in 1953; occupied temporarily in summer 1954–55
'Pendulo", Pendulum Cove, Deception Island, South Shetland Islands (lat. 62° 56′ S., long. 60° 36′ W.)	4 April 1949	Refuge hut; destroyed November 1950; rebuilt early in 1952; occupied temporarily by 3 men in January 1953, and again in summer 1954–55
'Petrel", Welchness, Dundee Island, off Trinity Peninsula (lat. 63° 29′ S., long. 56° 14′ W.)	1951–52 season	A "naval air station" hut established in 1951–52; occupied temporarily in summers 1952–53, 1953–54 and 1954–55
Duse Bay, Trinity Peninsula (lat. 63° 30′ S., long. 57° 09′ W.)	October 1953	Hut occupied intermittently by personnel from Hope Bay in 1954. Probably destroyed when View Point refuge hut erected (see p. 60)
'Lasala", Whalers Bay, Deception Island, South Shetland Islands (lat. 62° 59′ S., long. 60° 34′ W.)	14 January 1953	Occupied by 4 men; removed by British on 15 February 1953
'Bryde, Islote Ricardo", off east coast of Bryde Island, Paradise Harbour, Danco Coast, west Graham Land (lat. 64° 51′ S., long. 62° 54′ W.)	12 November 1953	Unoccupied refuge hut

Locality	*Date established*	*Notes*
"Ardley, Isla Vientecinco de Mayo", Ardley Peninsula, King George Island, South Shetland Islands (lat. 62° 12′ S., long. 58° 56′ W.)	6 December 1953	Refuge hut; occupied temporarily in summer 1954–55
"F. de Gurruchaga", Harmony Cove, Nelson Island, South Shetland Islands (lat. 62° 19′ S., long. 59° 13′ W.)	15 December 1953	Refuge hut; occupied temporarily in summer 1954–55
"Puerto Orne", about 5 miles south-west of Cape Anna, Danco Coast, west Graham Land (lat. 64° 39′ S., long. 62° 34′ W.)	23 December 1953	Unoccupied refuge hut; destroyed by gale in winter 1954
"Suecia" (or "Betbeder"), north-east tip of Snow Hill Island, James Ross Island group, off Trinity Peninsula (lat. 64° 22′ S., long. 56° 55′ W.)	1 January 1954	Unoccupied refuge hut
"Primavera", ("Cabo Spring"), Brialmont Cove, Hughes Bay, Danco Coast, west Graham Land (lat. 64° 13′ S., long. 61° 05′ W.)	23 January 1954	Refuge hut; occupied temporarily in summer 1954–55
Mikkelsen Harbour, Trinity Island, off Palmer Coast, north-west Graham Land (lat. 63° 52′ S., long. 60° 44′ W.)	? December 1954	Refuge hut; occupied temporarily in summer 1954–55
"Bouchard", Petermann Island, off Graham Coast, west Graham Land (lat. 65° 11′ S., long. 64° 11′ W.)	17 January 1955	Refuge hut; occupied temporarily in summer 1954–55
Dorian Bay, Wiencke Island, Palmer Archipelago (lat. 64° 49′ S., long. 63° 31′ W.)	21 February 1955	Unoccupied refuge hut
View Point, Duse Bay, Trinity Peninsula (lat. 63° 32′ S., long. 57° 24′ W.)	June 1955	Unoccupied refuge hut 1500 yards east existing F.I.D.S. hut
"Antonio Moro", Summit Ridge, Trinity Peninsula (lat. 63° 27′ S., long. 57° 02′ W.)	20 June 1955	Unoccupied refuge hut
"Cristo Redentor", 70 km. from Hope Bay	? June 1955	Unoccupied refuge hut. Precise locali not known
"Thule", Ferguson Bay, Thule Island, South Sandwich Islands (lat. 59° 27′ S., long. 27° 16′ W.)	? 1954–55 season	Unoccupied refuge hut
"Libertador", Persson Island, Röhss Bay, James Ross Island, off Trinity Peninsula (lat. 64° 12′ S., long. 58° 24′ W.)	19 August 1955	Unoccupied refuge hut


STATIONS
British (occupied)
Argentine (occupied)
Chilean (occupied)
American (unoccupied)
British (unoccupied)
Argentine (unoccupied)
Chilean (unoccupied)
SOUTH SHETLAND ISLANDS
HARMONY COVE
COPPERMINE COVE
YANKEE HARBOUR
ARDLEY PENINSULA
ADMIRALTY BAY
POTTER COVE
DISCOVERY BAY
GREENWICH ISLAND
HALF MOON ISLAND
DECEPTION ISLAND
SOUTH ORKNEY ISLANDS
SANDEFJORD BAY
SIGNY ISLAND
LAURIE ISLAND
SCOTIA BAY
CAPE GEDDES
PALMER ARCHIPELAGO
MELCHIOR ISLANDS
MIKKELSEN HARBOUR
CAPE LEGOUPIL
HOPE BAY
DUNDEE ISLAND
SUMMIT RIDGE
BRIALMONT COVE
DORIAN BAY
PORT LOCKROY
WIENCKE ISLAND
ARK BAY
CUVERVILLE ISLAND
CHEVALIER ISLAND
CUCKO HARBOUR
PARADISE HARBOUR
PETERMANN ISLAND
ARGENTINE ISLANDS
PERSSON ISLAND
SNOW HILL ISLAND
BISCOE ISLANDS
GRAHAM LAND
ADELAIDE ISLAND
HORSESHOE ISLAND
DEBENHAM ISLANDS
STONINGTON ISLAND
MARGUERITE BAY
ALEXANDER LAND
LARSEN ICE SHELF
Antarctic Circle
WEDDELL SEA
WEDDELL SEA
WASSEL BAY
STATIONS IN THE
FALKLAND ISLANDS DEPENDENCIES
1955
0 50 100 150 200 250 Nautical Miles
Pecked coastline is based only on rough reconnaissance
Approximate position of ice front

CHILEAN

Locality	*Date established*	*Notes*
"Arturo Prat", Discovery Bay, Greenwich Island, South Shetland Islands (lat. 62° 29′ S., long. 59° 38′ W.)	6 February 1947	6 men wintered in 1947; 7 men in 194 and 1950; 6 men in 1951; 8 men in 195 probably 10 men in 1955. Manned, since 1948, by naval personnel
"General Bernardo O'Higgins", Cape Legoupil, Trinity Peninsula (lat. 63° 19′ S., long. 57° 54′ W.)	18 February 1948	6 men wintered in 1948, 1949 and 195 7 men in 1951; 6 men in 1953. Manned by army personnel
"Presidente Gonzalez Videla", Paradise Harbour, Danco Coast, west Graham Land (lat. 64° 49′ S., long. 62° 52′ W.)	January 1951	6 men wintered in 1951; probably 8 me in 1952; 7 men in 1953. Manned by a force personnel
"Presidente Aguirre Cerda", Pendulum Cove, Deception Island, South Shetland Islands (lat. 62° 56′ S., long. 60° 36′ W.)	January 1955	Manned by naval, army and air for personnel (probably about 6 men)
Coppermine Cove, Robert Island, South Shetland Islands (lat. 62° 22′ S., long. 59° 45′ W.)	1949–50 season	Unoccupied refuge hut
Yankee Harbour, Greenwich Island, South Shetland Islands (lat. 62° 32′ S., long. 59° 47′ W.)	January 1953	Unoccupied refuge hut
Whalers Bay, Deception Island, South Shetland Islands (lat. 62° 59′ S., long. 60° 34′ W.)	January 1953	Temporarily occupied when Chilean ships visiting; removed by British o 15 February 1953
AMERICAN		
Stonington Island, Marguerite Bay, Fallières Coast, west Graham Land (lat. 68° 11′ S., long. 67° 00′ W.)	11 March 1940	Hut built by U.S. Antarctic Service Expedition and occupied until 22 Mar 1941; reoccupied by Ronne Antarcti Research Expedition on 12 March 194 evacuated 20 February 1948

ADMINISTRATION OF FRENCH ANTARCTIC AND SUB-ANTARCTIC TERRITORIES

[By a French law promulgated on 6 August 1955, and published in the *Journal Officiel la République Française* on 9 August, a new French Overseas Territory was created. A tran lation of the law is printed below. The new Territory, named "Terres Australes et Antar tiques Françaises", consists of Ile St Paul, Ile Amsterdam, Iles Crozet, Iles de Kerguel and Terre Adélie. Since 1924 these have been administered as Dependencies of Madagasca In future they will enjoy the administrative and financial autonomy of other French ove seas territories. The *Journal Officiel* of 15 September 1955 announced the appointment Monsieur Xavier-Charles Richert as the first chief administrator.]

Translation

LAW No. 55–1052 of 6 August 1955 conferring administrative and financial autonom on the Terres Australes et Antarctiques Françaises.

Following the resolution by the Assemblée de l'Union Française,

The Assemblée Nationale and the Conseil de la République have debated,

The Assemblée Nationale has adopted,
The President of the Republic promulgates the following law:

Article 1.—Île Saint-Paul, Île Amsterdam, Archipel Crozet, Archipel Kerguelen and Terre Adélie form an overseas territory having administrative and financial autonomy. This territory is called Terres Australes et Antarctiques Françaises.

Article 2.—This territory is placed under the authority of a chief administrator of Overseas France who shall be known as Administrateur Supérieur des Terres Australes et Antarctiques Françaises.

Article 3.—The Administrateur Supérieur shall be assisted by a consultative Council which shall meet at least twice a year.
This council shall consist of:

1. A member nominated for five years by the Ministre de la Défence Nationale;
2. A member nominated for five years by the Ministre de la France d'Outre-mer from amongst the members of the Office de la Récherche Scientifique;
3. A member nominated for five years by the Ministre de l'Education Nationale from amongst the members of the Centre National de la Récherche Scientifique;
4. A member nominated for five years by the Ministre chargé de l'Aéronautique Marchande;
5. A member nominated for five years by the Ministre de la Marine Marchande;
6. Two members nominated for five years by the Ministre de la France d'Outre-mer from those who have taken part in scientific expeditions in the Îles Australes et Antarctiques Françaises.

Article 4.—The council shall elect annually a chairman and a secretary. It shall be consulted on the budget proposals of the Terres Australes et Antarctiques Françaises. It shall be kept informed of, and consulted on, the plans of action, which is the object of the budget proposals submitted for its examination, and new scientific projects. Requests for concessions and development will be submitted for its inspection and advice. The advice of the council, together with the minutes of its meetings, shall be transmitted by the chairman to the Ministre de la France d'Outre-mer.

Article 5.—The credits necessary for the establishment, maintenance and functioning of the permanent staff of the Îles Australes, and of the expeditions to Terre Adélie and the Antarctic mainland, shall be included in the budget of the Ministre de la France d'Outre-mer.

Article 6.—The seat of administration is provisionally fixed in Paris. It may be transferred to any part of the Terres Australes by a decree made on the authority of the Ministre de la France d'Outre-mer.

Article 7.—The decrees made on the authority of the Ministre de la France d'Outre-mer, and if necessary by the Ministre des Finances et des Affaires Économiques, will lay down detailed regulations for the application of the present law.

Article 8.—All previous laws contrary to these provisions, in particular the Decree of 21 November 1924, which included Îles Saint-Paul and Amsterdam, Archipel Crozet and Archipel Kerguelen, and Terre Adélie in the administration of Madagascar, are abrogated. This law shall be executed as a statute law. Paris, on 6 August 1955

The Président of the Republic: René Coty.
The Président of the Conseil des Ministres: Edgar Faure.
The Ministre des Finances et des Affaires Économiques: Pierre Pflimlin.
The Ministre de la France d'Outre-mer: Pierre-Henri Teitgen.

STRAND CRACKS

There have been no adverse comments about the proposed use of the ter
strand crack[1] to refer to a fissure at the junction between an inland ice shee
and an ice shelf, the latter being subject to the rise and fall of the tide. Th
term is being adopted by the Hydrographic Department, Admiralty, and th
feature is shown on the latest Admiralty charts of Antarctic coasts.[2] Th
symbols shown opposite are to be introduced on future editions. It is importan
that surveyors in the field should be able to recognize strand cracks, which ar
sometimes the only surface indication of the inland boundary of an ice shel
Normally the boundary is conspicuous, because it coincides with the botto
of the slope of the inland ice sheet. Its position will be evident on a map fro
the contours. But strand cracks should always be plotted if they are seen, fo
they are a more reliable indication of the limits of floating ice. Without the ai
of seismic sounding the surveyor cannot, of course, attempt to plot th
"potential coastline" (i.e. the true coast if the ice were removed).

Strand cracks are distinct from other cracks on account of the continual tid
movement of the ice shelf, which maintains in all a newly formed appearanc
even though some may have persisted unchanged over a period of year
Characteristically, their lips project a few centimetres above the gener
surface level, so that cracks are conspicuous in spite of their width being sma
(see photograph). At low tide they are not normally more than 2 cm. acro
at the surface, and most close up completely at high tide. The width
strand cracks at the surface is not representative of the width beneath i
Normally, after the snow bridge has been broken with an ice axe, the crac
itself appears to be some 5–10 cm. wide. Several parallel strand cracks ar
commonly found close to one another. There is normally no relative movemer
in a vertical plane between the two sides of a crack. Most strand cracks co
tinue unbroken for long distances. In bad lighting conditions the strand crac
zone may often be located by the loud reports and other sounds which ar
emitted by the ice during certain periods of the tidal cycle.

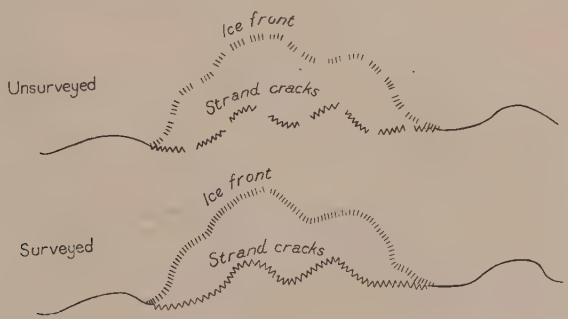
BRIAN ROBERTS
E. F. ROOTS
CHARLES SWITHINBAN

[1] Note in the *Polar Record*, Vol. 7, No. 49, 1955, p. 331–32.
[2] See, for example, chart Nos. 3170, 3171, 3174.

A strand crack

Photograph by Charles Swithinbank

Symbols used on Admiralty charts to illustrate this feature are shown below



(*Facing p.* 64)

CORRESPONDENCE

"ICE STREAMS"

Under the above title in the *Polar Record*, Vol. 7, No. 48, 1954, p. 185–86 and p. 231–32, I have noted with interest the remarks of Dr C. W. M. Swithinbank and Dr J. H. Roscoe. As the latter rightly maintains, there is definite need for clarification of the name in terms of its significance, when applied to this special flow-phenomenon of an inland ice sheet. In my chapter in *The Antarctic today*, entitled "Antarctic glaciers and glaciology", p. 33–34, I endeavoured to stress the special character of these discrete ice streams within the body of the inland ice, and I cited Hayes's remark that they represent a previously unclassified type of glacier. But his term "depression glacier", for several reasons, one of which is mentioned by Swithinbank, seems to be undesirable. Nor are many of the other terms suggested very much better, since they do not emphasize the special character of the feature, and its particular environment. The name "channel glacier", proposed by Roscoe, has a good deal in its favour, for, as he says, these features act as channels for massive movements of glacier ice, and may well follow definite drainage channels in the rock floor. But all these proposals, and certainly that of "ice stream", which is susceptible to variable connotation, appear to be unsatisfactory, unless given some qualification dependent on their particular environment. I should offer, therefore, for consideration three alternatives, viz.: "inland ice stream", "continental ice stream" or "arterial glacier", with preference for "inland ice stream". Thus qualified, this particular kind of ice falls into an appropriate geographical category, and its special character receives emphasis.

DEPARTMENT OF GEOLOGY, N. E. ODELL
UNIVERSITY OF OTAGO,
DUNEDIN, NEW ZEALAND

22 *December* 1954

We have read with interest Professor Odell's letter printed above. There is an important aspect, however, upon which he makes no comment, but which is mentioned by Dr Roscoe.

Not only do we need a term to describe the feature as such, but we need one which can be used in conjunction with a place-name, e.g. "Mertz Ice Stream". It must therefore be as brief as possible—"Mertz Inland Ice Stream" is cumbersome and thus probably unacceptable to place-name authorities. The term must also translate with ease into a number of languages. What would a Scandinavian think of "inlands-is-ström"? Norwegians already use "is-ström" for this type of glacier; not for a strip of sea ice.

These features appear both in inland ice sheets *and* in ice shelves; the type of ice sheet is not relevant. Moreover, since there are at least two examples in Dronning Maud Land where a stream debouches upon and continues in an ice

shelf, it would create an additional difficulty if we had to separate the two— particularly in a place-name. It is already clear that as the Antarctic con tinent is mapped we are going to need names for a great many of these features

These considerations have led us to favour "ice stream" by itself, althoug a longer term might well be more explicit.

SCOTT POLAR RESEARCH INSTITUTE
15 *May* 1955

BRIAN ROBERTS
CHARLES SWITHINBAN

DEFINITION OF "ICE RISE"

The note on "Suggested terms for ice features" by Roberts, Roots, an Swithinbank (*Polar Record*, Vol. 7, No. 49, 1955, p. 331–32) has led to th term "ice rise" being provisionally applied to certain features associated wit the northern Ellesmere Island ice shelf (*Arctic*, Vol. 8, No. 1, p. 20). If thi usage is acceptable, it is suggested that the proposed definition of "ice rise should be emended to read: "A mass of ice resting on rock, and surrounde either by an ice shelf, or partly by an ice shelf and partly by sea *and/or ice-fre land.*"

167 WOODSTOCK ROAD,
OXFORD
3 *July* 1955

G. HATTERSLEY-SMIT

[The writers of the note on "Suggested terms for ice features" agree that the definition h amended accordingly. See p. 7.]

DISCOVERY OF T-3

In perusing the Notes section of Vol. 7, No. 50, of the *Polar Record*, my eye fe with great interest on the report appearing on p. 416 devoted to Sovie sightings of ice islands, and especially on the following sentence of the secon paragraph: "This (an ice island) is identified with T-3, first sighted by th U.S. Air Force in August 1950 in lat. 75° 24′ N., long. 173° W. In fact, th original discovery of T-3 was made neither by United States nor Soviet ai craft, but by the Royal Canadian Air Force in April 1947, when it was sighte north of the Canadian arctic archipelago."

While, at this stage, no real importance should be attached to such matte as the discovery of ice islands, I think that, for the sake of the record, th actual facts should be related. The ice island that became designated T-3 wa first sighted at 08·35, G.M.T., 27 April 1947, by the crew of the U.S. Air Forc B-29 aircraft No. 45–21869, a few miles north of Isachsen Peninsula, Ell Ringnes Island, in approximately lat. 79° 50′ N., long. 104° W. As the senio officer present on this flight, I have taken the preceding data from my fligh notes.

Of course, the confusion over the original sighting of T-3 is not hard t explain. In the first place, the so-called first U.S.A.F. sighting of T-3 August 1950 actually means the first sighting of the ice island by a particula

squadron conducting arctic air reconnaissance; in this case, the 375th Reconnaissance Squadron. The mission and Headquarters of this Unit were in no way related to those of my own element, and the single identity of the two sightings was only established at a later date. That our sighting and that of 1950 were of the same feature is corroborated quite correctly on the map facing p. 684 of Vol. 6, No. 45, of the *Polar Record*.

It has been perfectly logical, also, to credit the discovery of T-3 to Canadian sources, for I believe that the first public mention of the 1947 sighting was made by Flight-Lieutenant (now Wing-Commander) Keith Greenaway, R.C.A.F., who, under the terms of a joint Canadian-United States agreement, was assigned to our aircraft as a navigator.

I well recall the sighting of T-3. Greenaway and I were stationed at the time in the extreme nose of the B-29, and we were immediately struck by the surface characteristics of the ice mass compared with the surrounding floes. Sir Hubert Wilkins was also an observer on this flight, and the three of us speculated at considerable length on what we saw. Sir Hubert was inclined to think of the feature in terms of paleocrystic ice, while Greenaway and I, who had the advantage of having flown over the Ellesmere Island ice shelf a few days earlier, strongly supported the thought that the ice island had come into being as a broken fragment of that ice shelf.

ARCTIC INSTITUTE OF NORTH AMERICA, WALTER A. WOOD
NEW YORK

20 *September* 1955

OBITUARY

Professor Haakon Shetelig died on 23 July 1955 at the age of seventy-eight. He was formerly director of the Bergen museum, and professor of archaeology in Bergen University, and he was a distinguished authority on Scandinavian pre-history and on the archaeology of the Vikings.

Monseigneur Arsène Turquetil was born in France in 1876 and died on 15 June 1955 in Washington. He went to Canada in 1900 and established mission stations at Chesterfield Inlet in 1912, at Eskimo Point in 1924, and on Southampton Island in 1925. In 1925 he was made Prefect Apostolic of Hudson Bay. He spoke Eskimo, Cree and Ojibway and designed typewriters for use with these languages.

Dr Robert Charles Wallace, C.M.G., died at Kingston, Ontario, on 29 January 1955 at the age of 73. He was born at Skea in the Orkney Islands on 15 June 1881 and went to school in Durness and Kirkwall. He took his M.A. at Edinburgh University, where he was medallist in natural philosophy, and later his B.Sc., for which he specialized in geology under Professor James Geikie. He then took his Ph.D. at Göttingen University. After a short time doing research at Dundee University he was appointed Lecturer in Geology at Manitoba in 1910, and Professor two years later. He soon became an authority on mineral resources in Canada and was appointed Commissioner for Northern Manitoba. In 1921 he became Commissioner for Mines and Natural Resources for the whole of Manitoba. During these years he travelled widely by canoe in summer and by dog-team in winter; like another Orkney man, Dr John Rae, he was able to defy hardships and to enjoy them. He was later recalled by the University of Manitoba, but continued to serve as a part-time Commissioner.

In 1928, he was appointed President of the University of Alberta, and in 1936 became Principal and Vice-Chancellor of Queen's University, Ontario, where he remained until his retirement in 1951. During this time Wallace had been President of the National Conference of Canadian Universities, of the Research Council of Ontario and of the Royal Society of Canada; he had received seventeen Honorary Degrees, and reached the position of leading elder statesman in Canadian universities. In 1951 he was appointed Director of the Arctic Institute of North America.

His old friend, Dr Hugh Marwick of Kirkwall, has written: "Wallace was a man of quite exceptional parts. A scientist by training and profession, he was at the same time a great humanist in the best sense of that term. He was in fact more, for in him to a higher degree than in anyone else I have known, there was the perfect synthesis of scientist, humanist and moralist, all fitly joined together and cemented by utter sincerity of mind and a wonderful overriding sanity of judgment." J. M. W.

RECENT POLAR LITERATURE

This selected tri-annual list has been prepared by R. J. Adie, Terence Armstrong, J. D. M. Blyth, Amorey Gethin, John Glen, H. G. R. King, Brian Roberts and Ann M. Savours. Readers can greatly assist by sending reprints of papers and reports. Attention is drawn to the bibliographies in each number of the *Journal of Glaciology*, which covers scientific aspects of snow and ice in all parts of the world. Both the *Polar Record* and the *Journal of Glaciology* deal with glaciological literature having specific polar interest and with general matters of a practical nature such as snowcraft. For Russian material the system of transliteration used is that adopted by the U.S. Board on Geographic Names and the Permanent Committee on Geographical Names for British Official Use (see the *Polar Record*, Vol. 6, No. 44, 1952, p. 546).

Reprints of "Recent Polar Literature", from Nos. 37/38 onwards, can be obtained separately (to allow references to be cut out for pasting on index cards) from the Institute, price 2*s.* 6*d.* for two reprints. Copies will be sent without charge to organizations with which the Institute maintains exchange arrangements and which notify their wish to receive them.

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Allgén, C. A. On some Arctic freeliving moss-nematodes collected by the Swedish Greenland-Expedition 1899. *Meddelelser om Grønland*, Bd. 107, Nr. 6, 1954. 10 p. [Found on Lille Pendulum, East Greenland, and Jan Mayen (one specimen).]

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ERRATA

The *Polar Record*, No. 49, January 1955

Page 308, line 34. *For* $31414+0{\cdot}45\,(H+0{\cdot}35h)$ *read* $31414\times 0{\cdot}45\,(H+0{\cdot}35h)$
Page 310, line 27. *For havet read have*
Page 311, line 30. *For* STOROZHEV, M. M. *read* STOROZHEV, N. M.
Page 311, line 33. *For* SVERDRUP, H. V. *read* SVERDRUP, H. U.

The *Polar Record*, No. 50, May 1955

Page 379, line 17. *For Automatic read Automotive*
Page 393, line 4. *For* Roman Catholic mission *read* Hudson Bay Company

The *Polar Record*, No. 51, September 1955

Page 464, line 12. *For* Isles *read* Iles
Page 465, line 2. *For* Canadian Defence Research Board *read* Defence Research Board of Canada
Page 465, line 26. *For* Canadian Defence Board *read* Defence Research Board of Canada
Page 480, line 14. *For* 40·9 *read* 12·8
Page 480, line 19. *For* 5·6 *read* 1·6
Facing page 490. *For Venture read Venturer*
Facing page 491. *For* Westfjorden *read* Vestfjorden
Page 496, line 16. *For* east *read* west
Page 497, line 1. *For* west *read* east
Page 508, line 36. *For* Lakesfjordvidda *read* Laksefjordvidda
Page 513, map and page 514, lines 5, 6 and 7. *For* "E" *read* Alfa, *for* "A" *read* Bravo, *for* "C" *read* Coca, *for* "D" *read* Delta, *for* "B" *read* Echo, *for* "F" *read* India, *for* "G" *read* Juliett, *for* "H" *read* Kilo, *for* "I" *read* Metro
Page 518, lines 28 and 32. *For* Isles *read* Iles.

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